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ABSTRACT

Guidelines are presented for use by driver licensing agencies in the development of driver manuals, tests, and other means of disseminating information and testing license applicants. An introductory chapter discusses the purposes of written license tests and of drivers' manuals, focusing on the needs of groups of drivers based on kind of vehicle, experience, age, driving record, reading ability, residence, and language. Chapter 2 outlines driver information needs for seven categories of drivers and suggests special approaches to the dissemination and assessment of that information. The seven driver categories are new drivers, renewals, older drivers, traffic violators, accident repeaters, drinking drivers, and special vehicle operators. Chapter 3 presents criteria for development of manuals (content, organization, and style) and other systems for presenting information to drivers (e.g., audiovisual presentations and group instruction). The selection of content for driver tests, preparation of test items, construction of tests, and consideration of alternative information assessment systems are covered in chapter 4. The final chapter describes techniques for evaluating the effectiveness of various techniques in leading to acquisition, retention, and application of driving information. (The guide grew out of a research project to develop and test an information system designed to meet the needs of various categories of drivers. The final research report and a summary of it are available as CE 015 838 and CE 014 870.) (JT)

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SAFE DRIVING KNOWLEDGE DISSEMINATION AND TESTING TECHNIQUES

Volume III: Handbook

Contract No. DOT-HS-4-00817
May 1977
Final Report

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

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16. Abstract

In order to determine the effectiveness of improved information dissemination and assessment techniques in reducing highway accidents, a set of seven targeted driver license manuals and tests were developed for the following groups of drivers: New Drivers, Youthful Drivers, Renewal Applicants, Older Drivers, Traffic Violators, Accident Repeaters, and Drinking Drivers. The contents of the manuals and tests were based upon an anlaysis of critical information requirements for each target group and an assessment of existing information deficiencies of drivers relative to these requirements. The manuals and tests were administered to a sample of 30,000 drivers, primarily from the State of Virginia, in order to determine their effectiveness in leading to acquisition, retention, and application of safe driving information. The assessment of information acquisition evidenced knowledge gains ranging between 20% and 33% for all target groups except the Traffic Violator group which showed only an 11% gain. A retention test administered to the New Driver and Renewal group after a five-month interval showed a 1/2 to 1/3 information loss. The Older Driver group showed a slight gain. The accident and violation records of drivers in all groups will be compared with those of a randomly selected control group of equal size over 12, 18 and 24 month intervals. In addition to the manuals, a one-hour audiovisual presentation covering the contents of the New Driver manual was developed and yielded information gain of 15% and 27%, respectively, among reading disabled and mentally retarded high school students.

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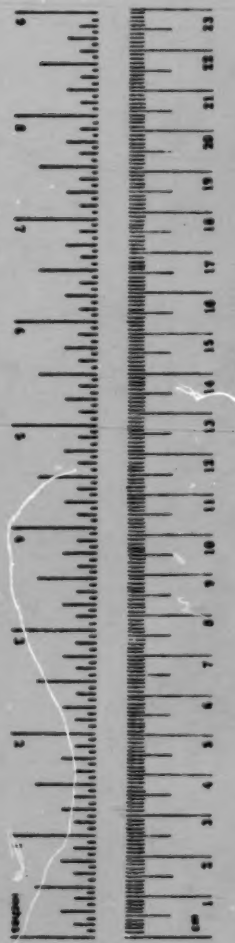
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

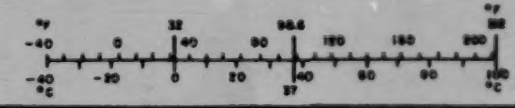
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

This Handbook provides a set of guidelines that may be used by driver licensing agencies in the development of driver manuals, tests, and other means of disseminating information and testing license applicants. It was prepared under contract to the National Highway Traffic Safety Administration (Contract No. DOT-HS-4-08817). The methods used in developing and evaluating the manuals and tests, methods used as a source for this Handbook, are described in a Technical Report entitled "Safe Driving Knowledge Dissemination and Testing Techniques: Final Report," June 1976. The manuals and tests developed under the project are on site with the National Highway Traffic Safety Administration. For information concerning the materials, write:

Driver - Pedestrian Programs
National Highway Traffic Safety Administration
400 Seventh Street, S. W.
Washington, D. C. 20590

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Dr. A. James McKnight served as Principal Investigator of the project and was assisted by Ms. Molly A. Green. Mrs. Wanda Dorpfeld was responsible for final editing and preparation of copy.

TABLE OF CONTENTS

	Page
CHAPTER I, INTRODUCTION	1
PURPOSE OF WRITTEN LICENSE TESTS	1
The Test as a Screening Device	1
The Test as a Diagnostic Device	1
Tests as Incentives	2
THE PURPOSE OF A DRIVERS MANUAL	2
DRIVER INFORMATION NEEDS	3
The Kind of Vehicle	4
Experience	4
Age	4
Driving Record	5
Reading Ability	5
Residence	5
Language	6
SAFE DRIVING INFORMATION SYSTEM	6
New Drivers	6
New Residents	6
Renewals	8
Problem Drivers	8
Special Vehicle Operators	8
A Goal	8
PURPOSE OF GUIDE	9
CHAPTER II, DRIVER INFORMATION NEEDS	11
NEW DRIVERS	12
What Do They Need to Know?	12
What Don't They Need To Know?	14
How Should It Be Presented?	15
RENEWALS	16
The Future Renewal Manual	17
Approaching Experienced Drivers	18

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Table of Contents Continued

	Page
OLDER DRIVERS	18
What Older Drivers Need To Know	18
Dealing With Older Drivers	20
TRAFFIC VIOLATORS	20
Who Are The Traffic Violators?	21
How Specific Should The Information Be?	23
How Many Violations?	23
Handling Traffic Violators	24
ACCIDENT REPEATERS	24
What Do You Tell Someone Who's Been In An Accident?	25
How Should The Accident Repeater Be Approached?	26
How Many Accidents?	27
DRINKING DRIVERS	27
Who Can Benefit From An Information Program?	28
What Kind Of Information?	28
SPECIAL VEHICLE OPERATORS	29
Motorcycles	29
Commercial Vehicles	30
School Buses	31
Emergency Vehicles	32
Recreational Vehicles	33
CHAPTER III, INFORMATION DISSEMINATION SYSTEM	35
CONTENT OF MANUALS	35
Does The Applicant Need It?	36
Can The Applicant Understand and Apply It?	37
Can The Applicant Remember It?	37
ORGANIZING CONTENT	38
Sections	39
Access To Information	39
Use of Principles	39

Table of Contents Continued

	Page
STYLE	39
Writing Style	40
Illustrations	40
ALTERNATIVE INFORMATION DISSEMINATION SYSTEMS	42
Requirements Of An Alternative Information Dissemination System	43
Alternative Presentation Systems	44
Alternative Delivery Systems	45
CHAPTER IV, INFORMATION ASSESSMENT SYSTEM	49
SELECTING TEST CONTENT	49
Criticality of Information	49
Representative Sampling	50
PREPARING ITEMS	51
Types of Items	51
Alternative Responses	53
Wording of Items	54
Use of Illustrations	55
CONSTRUCTING THE TEST	56
Test Length	57
Alternate Forms	57
Number of Forms	58
Equality of Forms	58
Knowledge of Results	59
Automated Testing	59
Immediate Feedback	60
ALTERNATIVE INFORMATION ASSESSMENT SYSTEMS	60
Requirements For An Alternative Assessment System	61
Alternative Approaches	63
Foreign Speaking Applicants	64

Table of Contents Continued

	Page
CHAPTER V, EVALUATION	65
EVALUATION OF INFORMATION ACQUISITION	65
Developmental Evaluation	65
Pilot Test Evaluation	67
Operational Evaluation	76
EVALUATION OF RETENTION	76
Retention Periods	76
Sample Selection	77
Retention Testing	77
Analysis of Results	78
EVALUATION OF INFORMATION APPLICATION	78
General Approach to Evaluation	79
Evaluation Procedures	84
Dissemination of Information	85
Information Assessment Procedures	86
Recording Information	87
Verification	87
Data Analysis	88

CHAPTER I

INTRODUCTION

PURPOSE OF WRITTEN LICENSE TESTS

What is the purpose of a written driver license test?

a. To help keep bad drivers off the road.

b. To identify knowledge deficiencies.

c. To get applicants to read the drivers manual.

There is no one "correct" answer to this question. The purpose of a written license test is whatever you are using it for. However, if you choose answer "a" or "b", you probably won't find this guide very useful. What's more, we don't think you will find your test is very useful either.

Let's look at each answer.

The Test as a Screening Device

"a. To help keep bad drivers off the road."

Does a written examination help to keep bad drivers off the road? Does it help keep anyone off the road? The evidence seems to be that very few drivers are prevented from driving by a written examination. If they don't pass the first time, they keep on taking it until they do pass. The great majority ultimately pass.

The fact that almost everyone ultimately passes a written test would not rule out answer "a" if those few who failed it were bad drivers. But, are they? Research shows that out of every 100 drivers who fail a test, somewhere over 95% of them would end up with driving records that are as good as the people who pass the test. A test that screens out almost as many good drivers as bad drivers isn't doing a very good job.

The Test as a Diagnostic Device

"b. To identify knowledge deficiencies."

Each wrong answer on the written test points to something the applicant does not know about driving. Certainly a test does diagnose knowledge deficiencies. But how well?

Knowing how to drive involves many hundreds of pieces of information. Even the most comprehensive written test covers but a small fraction of this information. It can, therefore, only identify a small fraction of the applicant's knowledge deficiencies. Certainly that's a help. But is it enough to justify giving a test?

There must be some other reason.

Tests as Incentives

That leaves answer c. "To get applicants to read the drivers manual."

How many license applicants would read a State drivers manual if they didn't have to take a test on it? The authority to issue a license, to grant or withhold an individual's access to the public highways, gives the State licensing agency control over a powerful incentive. Few educators can offer an incentive to learning that is as highly prized as a driver's license. By using a license test as a way of inducing drivers to obtain the information that's in the drivers manual, the State licensing agency is accomplishing what no other agency can.

Certainly a test should provide an accurate assessment of how much people know about driving. However, the assessment by itself won't make drivers any better. What it can do is to encourage drivers to study the manual and to learn enough of its contents to pass the test. And, it can encourage those who fail it to return to the manual and study harder.

There's no assurance, of course, that getting people to read a manual will make them better drivers. But whatever effect a test has upon safety is more likely to come through helping uninformed drivers to improve than by keeping them off the road.

THE PURPOSE OF A DRIVERS MANUAL

If it is the purpose of a written test to get drivers to learn what's in the drivers manual, what is the manual supposed to do?

a. Help people become responsible drivers.

b. Teach people how to drive.

c. Communicate State laws.

The purpose of a manual, like that of the test, is up to each individual State to decide. However, this guide is concerned only with the first purpose, "To help people become responsible drivers." It is based on the assumption that the State has both the right and an obligation to see that every driver who seeks access to the public highway is prepared to use it in a responsible way, giving no threat to the safety, health, mobility, or convenience of others. This Guide happens to focus exclusively upon safety. That is because it grows out of a highway safety project. However, pollution control, litter prevention, and environmental conservation are all aspects of responsible driving and, therefore, are legitimate subjects for a manual and written test.

Should a drivers manual attempt to "teach people how to drive"? Some manuals contain a good deal of information about driving fundamentals. However, developing the basic skills needed to drive a car would seem to be an educational rather than a licensing function. The role of the licensing agency should be primarily to make sure that those who do drive manage to do so in a responsible way.

What about a manual as a means of communicating traffic laws? Many drivers manuals do give a lot of attention to laws; some are almost "mini" vehicle codes. Since traffic laws are intended to promote responsible driving, publishing them would seem to fulfill purpose "a." But does it?

Not necessarily. First, traffic laws must be limited to those aspects of driving that lend themselves to enforcement. There are rarely any laws covering such things as the use of mirrors, being alert to cars pulling out of drive-ins, or adjusting brake pressure to surface traction. Secondly, to be enforceable, laws are often expressed in terms that are difficult for the driver to translate into action. For example, limits of alcohol consumption are expressed in terms of blood alcohol level rather than the number of drinks.

Drivers should know the law. However, there are better ways for a drivers manual to foster responsible driving than simply publicizing traffic laws.

DRIVER INFORMATION NEEDS

The driver manual and test, as viewed by this Handbook, are elements of an information system, the purpose of which is to see that drivers learn what they need in order to drive safely. The manual dispenses the information, and the test makes sure that they know it.

What kind of information do drivers need? The answer is another question: "What drivers are you talking about?"

Drivers are not all alike. Nor, do they have the same information needs. Some of the things that determine what drivers need to know are the kind of vehicle they operate, their age and experience, where they are from, their driving record, and their ability to read.

The Kind of Vehicle

People who operate different kinds of vehicles need different kinds of information. A motorcycle rider needs information that is different from that needed by the driver of an automobile, so does the driver of a truck or a school bus. True, there is a common "core" of information that operators of all motor vehicles need. However, a substantial portion of the information needed to operate a particular type of vehicle responsibly is unique to that kind of vehicle.

Outside of a few States that provide manuals for motorcycle or truck operators, States generally do not publish separate manuals covering different classes of vehicles. Often, what vehicle specific information is provided is squeezed into the drivers manual where it cannot be adequately treated.

Experience

The experience of the drivers also determines their information needs. Generally, the longer people drive, the more they know about driving and the less they have to be told. The person who has been driving for many years should only have to be informed of new laws or changes in the driving environment, or to be reminded of things that are easily forgotten. No State at the present time seems to provide this selected information. Those that require periodic re-examination of experienced drivers generally supply only the regular drivers manual.

Age

Different age groups have different information needs. Generally, the needs of youth are those of the inexperienced driver. True, youthful drivers as a group have problems other than inexperience---immaturity, poor judgment, unsafe attitudes. However, these problems can't be solved through a manual and test.

Where age gives rise to informational needs is in the advanced years where physical and psychological changes create a need for changes in driving. Both the need for changes and the nature of the changes can be communicated to all the drivers through a manual. At the present time only a few States provide a publication directed specifically toward the information needs of older drivers.

Driving Record

Several States along with many counties and municipalities, provide programs of driver improvement for people with bad driving records. Most of these programs are concerned, at least in part, with the dispensing of driving information. However, as sources of driving information current driver improvement programs suffer from the following general shortcomings:

- Relevance--The information provided is often unrelated to the specific nature of the driver's record.
- Threshold--Drivers having very few or relatively minor traffic offenses often cannot "benefit" from informational programs.
- Scope--Many programs are operated at a local level and do not serve the entire State.

Reading Ability

To gain knowledge from a manual, and evidence it on a written examination, a person has to be able to read. Many people who want to drive can't read, at least not well enough to pass a written test. Most States are willing to give an oral test to those who request it. None make a similar provision for the manual. Even having the manual or test read aloud may not be enough. Trying to absorb a manual or understand a test question when someone else is reading it is difficult for anyone. It can be almost impossible for people who have a basic language problem.

Residence

A driver who is transferring from one State to another needs information concerning those aspects of safe driving that vary from one State to another. State specific information includes traffic laws, e.g., whether or not a right turn on a red light is permitted, driving conditions, e.g., driving in snow, desert driving, or highway characteristics, e.g., traffic circles, or special signs and markings. At the present time, States do not provide manuals limited to State specific information. Rather, new residents receive the regular drivers manual and are administered a test covering things that they would have had to know in order to have been licensed in the State they came from. In an age of high mobility, where new residents account for a substantial share of licensing transactions, this practice is uneconomical of materials and time.

Language

There have always been substantial numbers of drivers who do not speak English. In some parts of the country, they make up a large portion of the population. Where the numbers speaking a particular language are sufficiently great, States frequently provide foreign language versions of the manuals and tests. However, drivers from less populous groups face problems similar to those of English-speaking illiterates in getting the information they need to pass a license test. They face an even greater problem in getting an examiner who can give them a valid oral test.

SAFE DRIVING INFORMATION SYSTEM

The figure on the next page illustrates how a driver information system might cater to the varying information needs of the driving public. The system divides drivers into five major categories:

- New Drivers--Applicants seeking their first drivers license.
- New Residents--Applicants previously licensed in another State.
- Renewals--Drivers seeking to renew their license.
- Problem Drivers--Drivers seeking to retain their license despite an unfavorable traffic record.
- Special Vehicle Operators--Licensed drivers seeking to operate a vehicle other than a private automobile.

Here, in brief, is how this system would work.

New Drivers

The heart of the system would remain the State drivers manual and test. The objective of this system element is to communicate all the information that is necessary for safe driving. The regular manual and test would be supplemented by foreign language versions for the most populous of foreign speaking groups, and an audio-visual version for those who are unable to fully comprehend written materials. Both of the supplemental forms would cover the same information as the standard manual and test.

New Residents

In the model system illustrated, new residents are assumed to have acquired most of the information they need through the drivers manual provided by the State in which they were first licensed. The supplement for new residents would cover only that information from the State drivers manual that is not common to all States.

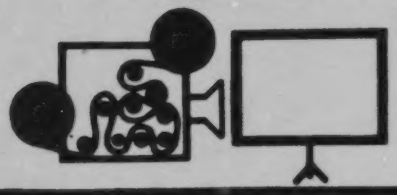
Driver Information System

New Driver

Foreign Speaking

Italian
Spanish
French
Etc...

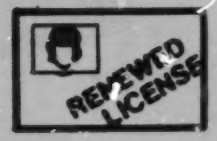
Reading Disabled



New Residents

drivers license

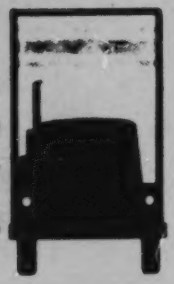
Renewals



DRIVERS
OVER 60 yrs.

Special Vehicle Operators

Truck
Bus
Motorcycle
Emergency
School Bus
Camper



Problem Drivers

Accident
Drunk Driver
Violator

Renewals

In the system as shown, licensed drivers would have been provided all the basic information they need for safe vehicle operation through the State driver manual and test. However, in order to remain responsible drivers, they would be provided, as part of their license renewal, a manual and test covering changes that have occurred since their license was issued or last renewed. Such changes would include new traffic laws, new signal markings and devices, or other changes in the highway system that would affect their driving. It would also cover information from the State driver manual that drivers are inclined to forget over a period of time. As they reach an advanced age---60 to 65---drivers would receive a supplemental manual and test covering those changes that occur in drivers themselves as a function of age.

Problem Drivers

Drivers who compile records of traffic violations or accidents would be provided manuals and tests designed to overcome the particular problems that led to their poor records. This element of the information system would come into play before their transgressions or misfortunes were severe enough to qualify them for the more intensive programs of "driver improvement."

Special Vehicle Operators

Licensed drivers seeking to operate a vehicle other than an automobile would be provided a manual and test covering the additional information required to operate that particular class of license to obtain a regular driver's license first. These applicants would receive the standard driver manual and test along with one prepared for their category of special vehicle.

A Goal

The driver information system pictured in the diagram is an ideal. Not many States would want to institute such an ambitious program. The fact is, none could institute it at the present time, even if they wanted to. Two big obstacles are the Renewal and New Resident elements of the program. Both of them are based on the assumption that the licensed drivers in any State have already gotten the basic information they need to drive responsibly from the regular drivers manual. In most instances, this assumption cannot be made. The drivers manual in many States deals with little more than the fundamental rules of the road. Even in States that do have a comprehensive drivers manual, many drivers got their licenses before the manual was issued, and some before there was any manual at all. The system is intended merely to represent a <u>goal</u> toward which States can direct their efforts in providing information to drivers.

The best that can be hoped for is that some States will be encouraged to try reaching some of the groups of drivers pictured with special information programs and materials. The system diagram is intended to show all of the things that can be done and how they can fit together into an integrated program of driver information.

PURPOSE OF GUIDE

This Guide has been prepared to help State driver licensing agencies do a better job of giving drivers the information they need in order to operate responsibly. The Guide grew out a research project performed by the National Public Services Research Institute (NPSRI) under contract to the National Highway Traffic Safety Administration. In brief, the project involved the development of an information system designed to meet the needs of various categories of drivers. The program has been administered on an experimental basis to some 30,000 randomly selected drivers in the State of Virginia. The effectiveness of the program will be evaluated by comparing the accidents and violations compiled by this experimental group with those of a randomly selected control group. A separate technical report described the methods used and the results that were obtained.[1]

The information used in preparing this Guide represents a mixture of data and opinion. The data come from the results of the project under which the Guide was prepared as well as the results of the many studies reviewed in carrying out the project. Similarly, the opinions represent both those arrived at by the project staff and those offered by the many individuals contributing to the project.

The remaining chapters of this Guide discuss the various elements of the State driver information system outlined in the previous section.

Chapter II, Driver Information Needs, discusses the kinds of information needed by each category of driver and the special approaches to the dissemination and assessment of that information.

Chapter III, Information Dissemination System, provides guidance in the development of manuals and other systems for presenting information to drivers.

Chapter IV, Information Assessment System, provides guidance on development of written tests and other approaches to the assessment of knowledge among drivers.

Chapter V, System Evaluation, describes techniques for evaluating the effectiveness of various techniques in leading to acquisition, retention, and application of driving information.

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[1] McKnight, A.J. and Green, H.A. "The Dissemination and Assessment of Safe Driving Information Among Driver License Applicants," National Public Services Research Institute, April 1975.

CHAPTER II

DRIVER INFORMATION NEEDS

What determines a driver's information needs? In this Guide, an "information need" is determined by two things:

- Criticality--How important is the information to safe driving?
- Deficiency--How many drivers lack the information?

An item of information becomes a "need" if it is critical to safe driving and if a substantial number of drivers lack the information. If the information isn't critical, or if drivers are known to have it already, then there is no need for the State to supply it.

Information deficiencies aren't hard to identify. You can simply test different groups of drivers to find out what they know and don't know. Much of the information used to identify information deficiencies in the driver manual came from tests that had been given by the States of Michigan and California. The rest came from tests given by the project staff.

Deciding how critical certain kinds of information are to certain kinds of drivers isn't so straightforward. There is no sure way of knowing what part particular items of information may play in reducing the number or severity of accidents. Estimates of the criticality of various kinds of information for various categories of drivers were obtained from two sources. One source was an exhaustive survey of the literature dealing with the special problems of particular categories of drivers. The second source was a set of questionnaires that were filled out by highway safety professionals, each of whom was a specialist in dealing with a particular category of driver. The questionnaire provided a long list of information items and called upon the safety professionals to identify those items that were particularly critical to drivers in their specialty. Those information items identified as "needs" in this chapter have been found to be critical to, and largely lacking among, drivers in a particular category.

This chapter will outline the information needs of the various groups of drivers, to the extent that they are known. Drivers with reading disabilities and those who speak a different language are not mentioned because their information needs are no different from those who are capable of reading English. What distinguishes them is their need for a mechanism for delivering the information.

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NEW DRIVERS

A manual for New Drivers, for people who have never had a license before, must contain all of the information that is critical to driving. It is the basic source of safe driving information for many new drivers. Even those who take driver education may use the driver manual as a text.

What Do They Need To Know?

The information requirements about to be described are based upon the results of an extensive analysis of the tasks that drivers have to perform. Those tasks that were critical to safe automobile operation formed the basis of New Driver information requirements. You will notice that the information requirements are not expressed in terms of tasks; there is no reference to tasks such as "passing," or "entering traffic." Rather, information requirements have been organized into more general principles of safe driving, such as "observing," and "communicating." This was done to enhance efficiency; the requirements of many tasks can be encompassed in a relatively few principles.

The following is a list of topics appropriate to New Drivers.

- Licensing Procedures--Since the applicant's purpose in reading the manual is to get a license, it is reasonable to open the manual with an explanation as to how this is done. The explanation should cover who must obtain a license, what licenses are required for what kinds of vehicles, where and when the license can be obtained, what documents must be supplied, what the license costs, and what the license examination consists of.

- Rules of the Road--This section would cover those devices and regulations by which the flow of traffic is regulated. Topics include traffic control lights and signs, right-of-way rules, lane use, and parking regulations. License tests show that New Drivers generally know the rules of the road. However, since many obtained their knowledge from a driver manual, the information must be considered a requirement for New Drivers.

- Observing--New Drivers tend to be preoccupied with the road immediately in front of the car. They require information that will lay the foundation for good seeing habits, including scanning of the roadway ahead, better surveillance of entering and crossing traffic, use of the mirrors, and over-the-shoulder checks. To improve their ability to see where they are looking, they need information concerning windows, windshields and mirrors, as well as the use of headlights at night.

- Communicating--New Drivers tend to over-rely on the ability of others to see them and divine their intent. They need information concerning the use of lights, horn, vehicle position, and emergency signals for making their presence known. They also need to know when and how to apprise others of their intent to change direction or speed.

- Speed Control--New Drivers are known to have more out-of-control, high speed accidents than experienced drivers. This finding has generally been attributed to youthful exuberance and daredevilry. However, it can also be traced to the inexperienced driver's failure to appreciate the effect speed has on the ability to control the car over various roadway surfaces, to detect potential problems when sight distance is limited, and to react to other road uses when traffic is heavy.

- Safety Margin--Inexperienced drivers tend to place too much trust in other drivers and, as a result, fail to allow an adequate margin of safety. They need information that will both enable and encourage them to maintain an adequate following distance, keeping ample distance to either side, to make allowances for identifiable problem drivers, and to give wide berth to emergency vehicles and school buses.

- Judging Distances--New Drivers are notorious for their inability to judge the distances they need to cross and enter traffic or to pass other cars. It takes a long time to develop this ability. In the meantime, they can be provided practical rules-of-thumb that will aid them in making correct decisions.

- Handling Emergencies--Most New Drivers, at the time they apply for a license, have barely enough skill to handle a normal driving situation, let alone cope with emergencies. However, if they aren't given the information at the time they are licensed, there is no way of being sure they will have it when they are prepared to use it. Information should include preventing and recovering from skids, avoiding and surviving collisions, handling vehicle emergencies such as brake failures and blowouts, and dealing with the consequences of accidents.

- Physical and Psychological Fitness--Because their driving skills are marginal, New Drivers are particularly vulnerable to any physical or mental condition that degrades their driving ability. The manual should help them identify and control potential sources of impairment. Major emphasis should be given to alcohol, including the seriousness of the drinking-driving problem, practical methods of controlling consumption, means of avoiding the need or tendency to drive after drinking, and the legal penalties for failure to do so. Attention should also be given to drugs (prescription, over-the-counter, and illegal), vision, hearing, fatigue, general health, and emotions.

- Vehicle Maintenance--There is a tendency for New Drivers to operate vehicles in a state of disrepair, owing partly to unfamiliarity with the vehicle's maintenance requirements, and partly to shortage of funds. They also have a tendency to give priority in maintenance to those things that make the car run rather than those things that affect safety of operation, such as tires, mufflers, brakes, and lights. It is, therefore, appropriate that a New Driver manual give substantial coverage to both the importance and nature of frequent inspection, servicing, and repair to safety-related equipment.

What Don't They Need to Know?

The drivers manual is the primary, if not sole, medium of communication between the State and the driving public. There is a tendency, therefore, to cram within its pages a lot of information that might, in a more highly differentiated information system, appear in other manuals. Some of the more common examples include the following:

- Special Vehicles--Some State driver manuals have sections on the operation of motorcycles, trucks or buses. Certainly these sections are a welcome acknowledgement of the need that drivers of these vehicles have for specialized information. However, it is far from efficient to include in a manual destined for all New Drivers information that is required by a small minority. The practical consequence of the attempt to accommodate all drivers with one manual is the tendency to skimp on the information needed by each. Under the proposed information system, information that is unique to a particular class of vehicle would be packaged in a special manual for operators of that vehicle.

- Driver Improvement Information--Some of the information that appears in State driver manuals is only relevant to those who have been convicted of a traffic offense. Examples of such information are descriptions of the State "point system," penalties for second time offenses, and license revocation and reinstatement procedures. The average driver can go several years without "qualifying" for such information. By the time it can do him any good, he has forgotten it. There is nothing really wrong with warning New Drivers of what is in store for those who are guilty of repeated offenses. However, if something must be sacrificed in the effort to provide New Drivers all the information they really need, most of the driver improvement information could be put in a letter or pamphlet that is sent to drivers after their first conviction.

- Vehicle Registration--A lot of the information in drivers manuals is concerned with registering vehicles rather than licensing drivers. Manuals identify requirements for vehicle registration, titling, insurance, and inspection. Including this information in the manual provides a convenient "one-stop" service for new residents, who generally have to register their vehicles at the same time they are getting a license. For every one else, however, the procedures seem inefficient. Why give an entire manual to someone who simply wants to register a car? It would be far more economical to put the vehicle-related information in a short four-page pamphlet.

How Should It Be Presented?

People who have prepared material intended for New Drivers generally agree that it should be factual, explanatory, and situational. These qualities are probably desirable in any material; however, they are particularly important for New Drivers. Here is why.

Facts. Safety communications have historically been long on emotional appeal and short on facts. Their creators often seem to be bent on inspiration, entertainment, or just plain attention getting, rather than enlightenment.

The teenagers who make up the bulk of the new driving population tend to be skeptical of anything that emanates from authority. The credibility of a manual will be enhanced by confining its messages to substantiated, factual information, making minimum use of generalities, platitudes, imperatives, or exclamation points.

Explanation. If there is one word that characterizes youthful learning, it is the word "why?" Partly out of curiosity, and partly because of the skepticism just mentioned, teenagers seek explanation and justification of the things they are asked to do. Driver manuals tend to be deficient in this regard. Why can't you pass at an intersection? Why do you have to drive so slowly in a residential area? Saying that it is "the law" is merely citing another authority.

Giving an explanation provides no assurance that rules and safe practices will be accepted. However, it probably does a better job of promoting their acceptance than does exhortation or emotional appeal.

Situations. New Drivers often have trouble relating concepts and principles to actual driving practice, owing to their unfamiliarity with the latter. They tend to lack the experienced driver's frame of reference. Principles and concepts should, therefore, be amplified by providing examples of their application. Principles such as "signal every direction change" need situational examples of direction changes, such as turning corners or changing lanes.

RENEWALS

If we could be sure that experienced drivers have a basic knowledge of safe driving, then we would only have to inform them of new things that have happened since they got their original license. However, the "if" is a big one. The results of tests given experienced drivers show that, on the whole, they are no more knowledgeable concerning the basics of safe driving than are new drivers. Certainly, experienced drivers know a lot; but so do New Drivers. When information criticality and deficiency are taken into account, the information needs of Renewal Applicants are almost identical to those of New Drivers.

This finding is not really surprising when you recognize that most of today's New Drivers are teenagers who have started or completed a driver education course before taking their written test. Since driver education has not always been as widespread as it is now, the majority of Renewal Applicants did not have access to this source of information. While the lessons of experience are valuable, they do not totally compensate for lack of instruction.

Of the topics listed in the New Driver section, only the following can be safely deleted from a manual intended for the average experienced driver of today:

- Licensing Procedures--This information is clearly irrelevant to drivers who already have licenses.
- Rules of the Road--Both new and experienced drivers know most of this information. However, experienced drivers know it without having had to read a manual.

- Judging Distances--The ability to judge distances involves a perceptual skill that most experienced drivers already have. Information in the New Driver manual is just a stepping stone to the development of this skill, not a means of improving it.

The remaining topics are as important to experienced drivers as they are to New Drivers. The same topics will be found in courses intended for improvement of licensed drivers.

The Future Renewal Manual

If all licensed drivers could be exposed to a comprehensive information program--perhaps through a one-time administration of a comprehensive manual and test--then further dissemination of information could be confined to things that have occurred since they last renewed their license. Such new information could include the following:

Regulations--New laws or changes in the old ones, including:

- Permitted or prohibited maneuvers, e.g., U-turns, right-on-red.
- Right-of-way rules, e.g., school buses, bicycle trail crossings.
- Alcohol and drug regulations, e.g., presumptive levels, implied consent.
- Penalties for violations, e.g., period of license suspension, dollar limits.
- License requirements, e.g., endorsements for particular categories of vehicles.
- Vehicle equipment and inspection, e.g., restraint systems.

Conditions

- Signs and signals, e.g., symbolic signs, metrics.
- Markings, e.g., reversible lanes.
- Highway configurations, e.g., freeway interchanges.

New Ideas

- Newly discovered hazards, e.g., the effects of certain drugs.
- New driving concepts, e.g., methods of determining following distance.

Approaching Experienced Drivers

Experienced drivers cannot be counted upon to recognize or admit their knowledge deficiencies. This is probably one of the reasons why they have been generally resistant to a written renewal examination. One way to overcome this resistance is to convince them, or let them convince themselves, that they really don't know as much about driving as they think. The best way to do this is by giving them questions they cannot answer. The questions could appear at the front of a renewal manual, or could introduce sections of it. Obviously, in order for this approach to work, the questions must deal with the less well known aspects of driving. Otherwise, it's liable to convince them of the wrong thing.

Information programs for experienced drivers don't have to be tied to the renewal process. Voluntary programs can be offered to the driving public at large to improve their knowledge of safe driving. Many programs are currently offered, by employers, military services, and community agencies. However, a license agency's primary access to the driving public at large is through the renewal process. License agencies are unique in their ability to make the possession of driving information a condition of license retention. It would seem best to exploit this special advantage before undertaking activities that other organizations can do equally well.

OLDER DRIVERS

On a per-mile basis, drivers over the age of 60 present accident records that are similar to those compiled by youthful drivers. It is only the relatively small numbers involved and the lower miles driven that keep Older Drivers from becoming a major highway safety problem.

What Older Drivers Need To Know

Of all of the groups targeted by the proposed safe driving information system, Older Drivers present the most clearly differentiated set of information needs. These information needs are not a product of age itself, but rather result from psychological and physical problems that occur more and more frequently with advancing years. No manual can alleviate these problems. However, a manual can help those afflicted to identify the problems, to seek help in overcoming them, and to alter their driving in terms of them.

Here are the major problems found among older drivers:

- Slowing of Physical and Psychological Processes--Age is accompanied by a slowing of reaction time and the ability to process information. This frequently manifests itself in driving at slower speeds and in making sudden stops or turns. Older Drivers can be helped to anticipate and guard against these tendencies, to drive at such times and in places as will help these tendencies from causing accidents, and to use other people to help in a way that will compensate for their own limitations.

- Physical Restrictions--Arthritis and other orthopedic problems often limit the Older Driver's physical movement. Probably the single biggest problem is the difficulty some Older Drivers have in turning their heads to see behind them. This can be partially offset by installing special mirrors, and by operating the car so that the need for head turning is reduced.

- Seeing and Hearing--Impaired vision and hearing are common symptoms of age. Typically, the onset is so gradual that the loss isn't recognized until it becomes severe. Older Drivers should be encouraged to have their vision and hearing checked frequently, and provided guidance on ways to adjust their driving to uncorrectable losses.

- General Health--A number of general health problems increase in frequency and severity with advancing years. As a result, many Older Drivers tend to tire easily and to experience dizzy spells or even blackouts. They should be encouraged to seek medical treatment and to adjust to their limitations in the way they drive, particularly in the scheduling of long trips.

- Medicine--The medicine that Older Drivers take to control various ailments may have side effects that impair driving. This is particularly likely to happen when medicines are used in combination with one another or with alcohol. Older Drivers should be informed as to the potential effects of medicines and encouraged to limit their driving accordingly.

- Driving Alternatives--Many drivers ultimately reach a point where they cannot drive safely. Drivers in this situation should be encouraged to avoid driving and be provided information as to alternative modes of transportation, names of organizations that provide transportation assistance, and political means for securing additional assistance.

Dealing With Older Drivers

A program of information intended for Older Drivers faces both physical and psychological obstacles. The physical problem is the most easily overcome. With age, the eyes lose their ability to focus upon things close up. If a manual is to be read, it must be printed in large, bold, clear type--minimum of 10 point. Illustrations must magnify any important details.

The psychological obstacle is that of resistance. Few people of advancing years care to be reminded of their age or the infirmities that accompany it. There are two things that can help to overcome resistance. First, the manual can avoid appearing to inflict upon Older Drivers problems that they don't have. It should acknowledge that the problems are not problems of age itself but more general problems that happen to occur with increasing frequency among Older Drivers. Readers should decide for themselves what information applies to them.

The second way of overcoming resistance is to enlist the aid of the Older Drivers' contemporaries. If you have to hear about your limitations, it is easier to hear about them from somebody who shares them with you. Manuals for Older Drivers can be disseminated through retirement associations, senior citizens groups, old-age assistance agencies, and the like. They may be introduced by some respected person of advanced years, either in person or through a covering letter or preface.

It is easy to "bend over backwards" in attempting to soften the impact of unwelcome information on Older Drivers' problems. The result may be that they conclude they have nothing to worry about before they begin to read the manual. It is important that the potential safety hazard represented by age-related problems be stated in a straightforward manner. While it may antagonize some, it may also keep others from being the cause of injury or death. Actually, when a manual employing a straightforward approach was evaluated in the State of Virginia, only one complaint was received from the 4,000 Older Drivers receiving the manual.

TRAFFIC VIOLATORS

Most people pick up a traffic ticket sometime in their driving careers. Does that make them Traffic Violators?

To most people, a "Traffic Violator" is someone who drives recklessly or thoughtlessly. Traffic Violators speed, and cut in and out of traffic. They pile up one ticket after another. If their licenses are suspended, they drive anyway. They are the people who have all the accidents.

Are there such people?

Certainly there are. However, there are not many of them. They account for less than 5% of the driving population. They also account for an equally small percentage of accidents. A manual aimed solely at such a small group wouldn't accomplish much even if it could affect their driving--and there is not much hope of that.

Who Are The Traffic Violators?

Most traffic citations are issued by people with pretty normal driving records, people who pick up a ticket every one in a while. Even if they have two or three violations in a year, they may go the next few years without having any. The great majority of drivers fall in the Traffic Violator category.

There are, of course, drivers who practically never break a traffic law--quite a few of them. But, they are still a minority. For the driving population at large, the question of who are the Traffic Violators pretty much boils down to who got caught.

Whatever differences there may be between the people who have been convicted of traffic violations and those who haven't, the differences don't show up on written tests. A comparison between the test results of the best and the worst drivers shows the same pattern of right and wrong answers.

If the difference between Violators and non-Violators largely boils down to who got caught, how can we justify a special information program for Violators?

The best answer is that they have "earned the opportunity." The fact that they have had a violation justifies the State stepping in and requiring them to read a manual and to take a test. True, the same information would do just as much good for non-Violators. However, there is no basis for imposing the requirement on drivers with clean records--until they too "earn the opportunity."

A manual for Traffic Violators should have something to do with violations. But what? Simply reciting the law won't do much good. While there may be a lot of laws that drivers don't know about, they aren't the ones that account for the majority of traffic violations.

People violate traffic laws for many reasons. They may be inattentive, indifferent, impatient, or overly agressive. There's little that a manual can do about these personality characteristics. Some people, however, violate laws because they don't see the reason for them. They may believe that breaking a particular traffic law on a particular occasion simply isn't unsafe. Sometimes they are right. However, often they aren't fully aware of the reasons behind that law. Revealing those reasons--giving some of the "little known facts" about various traffic laws--may help change their attitude toward the law. There is no assurance of it, of course. People can recognize that something is dangerous and do it anyway.

Here are some of the most commonly violated laws:

- Exceeding the Speed Limit--This is typically the most common violation. When drivers deliberately exceed the speed limit it is often because they think the limit is too low. They fail to recognize the things that may happen to force them to stop quickly. Or, they underestimate how long it will take to stop at the speed they are traveling. Enlightening them on these factors, and the way these factors are considered in setting the speed limits, may breed somewhat greater respect for the limits themselves.

- Driving Too Fast For Conditions--Some drivers consider the posted speed to be safe and lawful regardless of conditions. They need to know the effect that roadway conditions and visibility have upon maximum safe speed--and upon the legal limit.

- Following Too Closely--When one driver rear-ends another, he may be tagged for a traffic violation, even if the other driver stopped without warning. Violators should know why the law holds them responsible for maintaining a safe following distance, and how they can judge what a safe distance is.

- Unsafe Passing--Some drivers think that it is all right to violate a no-passing zone as long as no one else is coming. They problem is that they often can't tell whether someone else *is* coming, or how quickly that car might be on top of them.

- Right-of-Way Laws--A right-of-way violation usually means that two drivers collided and one is held to be legally at fault. Most often the "at fault" driver simply didn't see the other car coming. Sometimes, however, he saw the other car and didn't know who was to yield the right-of-way, or simply assumed the other driver would yield. A clarification of right-of-way laws may help prevent some right-of-way violations.

- Failure to Come to a Complete Stop at a Stop Sign--Many, if not most, drivers think a "rolling stop" is perfectly safe. They do not realize how even the slightest motion of the car affects their ability to detect and judge the speed of approaching vehicles.

- Running a Red Light--A lot of drivers believe that entering an intersection on a yellow light gives them a prior claim, even if they are still in it when the light turns red. What they don't allow for is another driver trying to get a jump on the green light.

- Penalties--The section on New Drivers urged that penalties for second offenses, details of the State "point system," and other information that applies only to people that have been convicted of a traffic violation be kept out of the New Driver manual. A manual for Violators provides a mechanism for communicating such information to people who can use it.

How Specific Should The Information Be?

Should Violators be given information about all traffic laws, or only the one they violated? If the idea is to make the information relevant, then someone who exceeds the speed limit should get a pamphlet on speed limits. Someone who coasts through a stop sign should get a pamphlet on stop signs.

Making information this specific would be all right if Violators tended to be as specific in their violations. But, they aren't. The things that lead a driver to break one law often lead him to break a different one as well. The driver who is impatient enough to attempt an unsafe pass is often impatient enough to run a yellow light or to tailgate the car ahead. If such a driver got caught often enough he would eventually get several pamphlets---but only after each violation. Doesn't it make more sense to give the driver all of the information after the first violation and possibly prevent the others from happening? Conviction for any traffic offense should be sufficient to establish the relevance of a manual dealing with general traffic laws.

How Many Violations?

How many of what kind of violations should it take for a driver to earn the label "Traffic Violator?" Being singled out for attention on the basis of one minor violation is likely to be viewed by the average driver as something of an over-reaction. Yet, if we wait until a driver has a long string of violations before sending out information, the information will come too late.

The threshold for action in most States is one serious violation (e.g., reckless driving) or two lesser violations over some specified period of time, such as a year. Some "point systems" take into account the specific nature of the violation and accumulate them over periods of time up to three or four years. In some jurisdictions, a driver at this level is sent off to a traffic school or a clinic. More often, however, the officer is confined to issuance of a warning letter. This would seem to be a good point at which to introduce a Violators manual. Rather than simply being alerted to the penalties that await further transgressions, the driver could be provided substantive information that might help in heeding the warning.

Handling Traffic Violators

Being convicted and fined for traffic violation hardly puts an individual in a mood to recieve a manual on traffic laws, let alone read it and take a test on it. Driver improvement analysts and instructors are familiar with the hostility that generally prevails during initial stages of a program for Traffic Violators. Those who are skilled can neutralize this hostility through manipulation of interview or group discussion processes. A manual is helpless in this regard. The Traffic Violator can, of course, be forced to read a Violators manual as a condition for retaining his license. But is that likely to breed the respect for traffic laws that the manual seeks?

If the contents of a Violators manual are to be accepted, the reader must be put in a receptive frame of mind. Where the manual is used as part of a driver improvement program, it can be introduced after the hostility has had a chance to subside. If it is being used independently, some other approach must be taken to foster acceptance of the manual. One approach might be to offer the reading of the manual and completion of the test as an alternative to attendance in a driver improvement program. There is not enough experience in use of informational communications with Traffic Violators to offer valid advice on what will work. However, if Traffic Violators are expected to adopt a favorable attitude toward traffic laws, they must first be induced to adopt a favorable attitude toward the manual itself.

ACCIDENT REPEATERS

People who seem to have more than their share of accidents are often considered "accident prone." It isn't that they drive recklessly or carelessly. Somehow they don't seem to be able to stay out of accidents.

There probably are people whose driving makes them particularly likely to have accidents. Some are people who have trouble keeping their minds on what they're doing. Others may have slow reactions. Some simply can't see well enough to drive safely. However, truly "accident prone" drivers are a lot like chronic Traffic Violators--there aren't many of them. The few there are account for only a small percentage of accidents.

Most of the accidents, like most of the violations, involve people with fairly normal driving records. If one driver has more accidents than another, it may be due to the amount he drives, or the conditions under which he drives or just plain bad luck. It doesn't necessarily mean that he is any different from other drivers. Yet, whatever the cause, having several accidents, like getting several tickets, "earns" the drivers the opportunity to receive information that may improve their driving.

What Do You Tell Someone Who's Been In An Accident?

If an accident involves a traffic violation, the driver who was guilty of the violation would get the information intended for Violators. But what about the driver who was not tagged for the violation? What kind of information can we give someone who has simply <u>been in</u> two or more accidents?

A logical answer is "information on how to avoid another accident." The subject is generally known as "defensive driving." The idea of defensive driving is driving in a way that protects one against the mistakes of other drivers. Among the more critical principles of defensive driving are the following:

<u>Observing</u>

- Looking well ahead and scanning the roadside to spot problems in advance.
- Checking the path ahead before turning corners or entering intersections.
- Never taking the eyes off the path ahead for more than an instant.

<u>Speed</u>

- Slowing and proceeding cautiously at intersections, regardless of traffic lights, right-of-way laws, or the signals of other drivers.
- Slowing when vision is restricted by other cars, hills and curves, things along the roadside, or bad weather.
- Maintaining the speed of traffic when entering, driving on, or leaving the highway.
- Avoiding sudden stops unless absolutely necessary.

Communicating

- Giving signals well in advance even when no other cars are visible.
- Warning following drivers of trouble ahead or imminent stops.
- Assuring visibility to other drivers by avoiding blind spots and establishing eye contact.
- Improving visibility of disabled vehicles through positioning and use of emergency signals.

Safety Margin

- Maintaining a safe following distance even in heavy traffic, when turning corners, and entering traffic.
- Giving way to other drivers as a courtesy, to smooth traffic flow, or to prevent an accident.
- Avoiding driving alongside other cars, when it isn't necessary.
- Giving wide berth to drivers whose visibility is obscured, who are looking the other way, or who do not appear to be paying attention.

Collision Avoidance

- Use of proper steering and braking techniques.
- Leaving the roadway if necessary.
- Use of seat belts to improve control and chance of survival.

How Should The Accident Repeater Be Approached?

Gently and diplomatically. Having just been in an accident won't make a driver particularly receptive to information from the Motor Vehicle Department. "First this clown hits me from behind, then I get a manual--and a test." Most drivers will see themselves as innocent victims. They may actually be right, although most of them will have shared some of the responsibility for at least one of their accidents.

How can a manual be justified to the accident "victim"?

The defensive driving orientation will help. The manual can be presented as a service designed to help drivers from having accidents "happen

to" them. The idea of "shared responsibility" should also be introduced. The reader should be led to recognize that few accidents are completely the "other guy's fault." This doesn't mean that the manual should start off by telling the driver that he is partly responsible for his accident. It should be possible to weave into the discussion of defensive driving illustrations of the way in which accident victims often invite trouble.

Getting drivers to take a test will be more difficult. Few States give the driver licensing agencies the authority to require a driver to take a test simply because he has been in an accident. Some success has been achieved with a voluntary, mail-back test. Many drivers will respond either out of a spirit of cooperation or because they want to stay on the good side of the licensing agency. Since the test is self-administered it becomes an "open book" exam, although most drivers will take the test from memory (why bother to look up the answer if the test isn't going to count anyway?).

How Many Accidents?

The issues involved in deciding when to send a manual and a test are about the same as they were in the case of Violators. One accident seems premature; several accidents too late. Here again, two or three seems reasonable. However, since accidents are fewer in number than violations, the period of time over which accidents are counted could be extended to two or three years.

It seems logical that the driver's culpability should have something to do with the number of accidents that are allowed. A driver might receive the manual after only one accident if he were responsible for it. The problem with using culpability is the practical one of determining who was at fault. It can be very hard to determine from accident records unless one driver has been charged with a violation--in which case that driver would have been considered a "Violator." Unless there is a good objective system for determining culpability, it is probably best to treat all accidents alike (with the obvious exception of those involving unattended vehicles).

DRINKING DRIVERS

One type of traffic violation that can reasonably be made the subject of communication is the drinking-driving offense. Two things distinguish such offenses as "Driving While Intoxicated" or "Driving Under the Influence" from other catagories of violations. First, the violation basically has nothing to do with driving itself but another activity entirely--drinking. Secondly, it is far more serious than any other violation insofar as its consequences are concerned.

Recently, an increasing number of States and communities have set up programs of education and therapy for convicted Drinking Drivers. Such programs are, however, far from universal. The majority get nothing beyond a fine, license suspension, and/or increased insurance premiums.

Who Can Benefit From An Information Program?

The term "Drinking Driver" covers a wide range of people. Not all of them are logical targets for an information program.

At one extreme is the "problem drinker," the person whose drinking interferes with his ability to lead a productive life and yet who can't give it up. New information won't help drinkers of this caliber. It probably can't even encourage them to seek help. By the time they have reached this stage, they are generally pretty well informed and quite practiced in resisting efforts to assist them. If anything is going to work it is a program of intensive psychological support or therapy of a psychiatric or chemical nature.

One rung down from the problem drinker is the "heavy drinker," the individual who drinks too much and too often but still leads an otherwise normal life. The heavy drinker may be induced to cut down on his consumption. However, it is likely to take a program of education or group therapy.

At the bottom of the ladder is the "social drinker," the individual who consumes alcohol in moderation. The social drinker has no real problem with alcohol until he gets behind the wheel after having had too much to drink to drive safely. He doesn't need to give up or cut down on his drinking; he only needs to separate it from his driving. Here is where information may help.

What Kind Of Information?

A manual for convicted Drinking Drivers should (1) convince them that drinking and driving is a problem, (2) help them control their drinking before driving, (3) help them control their driving after drinking, and (4) apprise them of what can happen if they don't do either (2) or (3).

The Drinking-Driving Problem-- The Drinking Driver has been, and still is, widely portrayed as the subject of humor. The following kinds of information may help convince Drinking Drivers of the seriousness of the problem:

- The accident and fatality rate resulting from drinking and driving.
- The effect of alcohol upon the psychological and physical processes involved in driving.

Control of Drinking--Most purely social drinkers have the power to control their consumption. The following kinds of information may help them to do so:

- The relationship of alcohol consumption to driving impairment.

- Factors affecting this relationship (e.g., weight).

- Practical methods of controlling consumption.

Controlling Driving--Sometimes it is easier to change people's driving than to change their drinking. Information that may help induce change includes the following:

- The need to delay driving after drinking, dispelling myths about "sobering up."

- Allowing others to do the driving.

- Alternative forms of transportation.

Legal Sanctions--Most convicted DWI's suddenly become very knowledgeable about the legal aspects of drinking and driving. However, their "knowledge" is frequently subject to misconception. They should be provided accurate information regarding:

- Penalties for second-time drinking-driving convictions.

- Chemical tests and implied consent laws.

- Reasons for stiff drinking-driving penalties.

SPECIAL VEHICLE OPERATORS

Most elements of driving safety cut across all classes of vehicles--motorcycles, commercial vehicles, school buses, emergency vehicles, and recreational vehicles. However, there are some things that are quite specific to individual classes of vehicles. If this specialized information is to be treated in adequate depth, it can only be done in a special, vehicle-specific manual.

Motorcycles

The special information needs imposed by motorcycles are recognized in more States than are those of any other class of vehicle. The overwhelming majority of States now require a special license of endorsement for Motorcycle Operators. Most require the prospective operator to pass a written knowledge test. A large and increasing number of States make available a separate Motorcycle Operators Manual.

The following is an outline of motorcycle information requirements:

- Protective clothing and equipment including helmet, eye and face protection, and protective clothing.

- Pre-operative inspection, including tires, controls, lights, and chain.
- Vehicle control requirements, including body position, turning, braking, and gear shifting.
- Being seen, including use of headlight, clothing, horn, vehicle position and signaling.
- Visual scanning, including road surface conditions, "headchecks," use of mirrors, and positioning for maximum visibility.
- Maintaining a safety margin from passing vehicles, vehicles at intersections, parked cars, merging cars, tailgaters and "lane sharers."
- Handling potentially dangerous surface conditions, including slippery surfaces, uneven surfaces, grooves and gratings, and sloping surfaces.
- Night riding, including quick stops, obstacle avoidance, surmounting obstacles, flying objects, animals, blowouts, stuck throttles, and "wobble."
- Carrying passengers and cargo, including equipment requirements, instructing passengers, securing cargo, and operating with passengers or cargo.
- Group riding, including group size, group cohesiveness, and use of staggered formations.
- Factors affecting rider fitness, including alcohol, drugs, weather, and fatigue.
- Motorcycle characteristics, including purchase, maintenance, accessories, and modifications.
- License testing, including skill test and road test requirements.

Commercial Vehicles

Commercial vehicles--straight trucks, tractor-trailers, and buses are subject to Federal Motor Carrier safety regulations when they operate across States. These regulations, along with those of the companies operating the vehicles are supposed to see to it that drivers of interstate vehicles have received enough training to assure their knowledge

of safe operation. Drivers of vehicles owned by small companies operating totally within a city or a State may receive little or no driving instruction.

Many States devote sections of their drivers manual to requirements of trucks and buses. However, the information focuses more upon the equipment, inspection, and licensing requirements of the vehicles themselves than upon the way in which they are operated.

Topics that are unique to commercial vehicles, and therefore candidates for a Commercial Vehicle Manual, include the following:

- Pre-operative checks and adjustments.
- Required accessories, including lights, horns, mirrors, and ownership identity signs.
- Required safety equipment, including fire extinguishers, reflective triangles, spare lighting equipment, flares.
- Requirements relating to maximum height, length, width, and weight (gross weight or axle weight) of vehicles.
- Cargo regulations covering hazardous materials, prevention of spills, and loading or unloading requirements.
- Roadway hazards, including low bridges, narrow tunnels, and such imposed obstructions as overhanging electrical wires and trees.
- Operating requirements relating to maintaining speed on an upgrade, control on downgrades, and securing the vehicle when parked.
- Information specific to tractor-trailers, including coupling and uncoupling procedures, safety chains, automatic brake application devices, and regulations covering the number of trailers or specific dimensions.
- Information specific to buses including regulations covering pickup and discharge of passengers, and required equipment such as emergency exit lights and doors, first aid kits, fire axes, and pop-out windows.

School Buses

The majority of States require School Bus Drivers to pass a special written test. However, many only require the standard chauffeur's test and a few only require the regular driver examination. In some school districts, the lack of a special written test is offset by a formal program of instruction given by the pupil transportation or driver education agency.

Yet, large numbers of School Bus Drivers never receive any safety-oriented instruction.

Information requirements appropriate to school bus operation include the following:

- Pre-operative checks, including signal lights, headlights, mirrors and windows, rear door and brake systems.
- Loading and discharging of pupils, including use of signal lights, stopping, traffic checks, use of doors, entry and exit procedures, and unscheduled stops.
- Passenger supervision, including location and seating of students, maintaining discipline, and use of seat belts (where provided).
- Special operating requirements, including surveillance of children near stops, backing up, and stopping at railroad crossings.
- Emergency procedures, including skid recovery, brake failure, passenger injury, and accidents involving other vehicles.
- Special requirements for transporting handicapped students.

Emergency Vehicles

Police vehicles, ambulances, rescue vehicles, and fire trucks pose a particular threat to highway safety owing to the speeds at which they travel, their breeching of rules of the road, and the characteristics of the vehicles themselves. It does not appear that any State requires special licenses or license tests of Emergency Vehicle Operators at the present time. The responsibility for making sure that drivers are qualified is typically left to the State, local, and private agencies carrying on the operations themselves. In many agencies, the training and assignment of operators is tightly controlled by agency policy. However, in many organizations--ranging from small volunteer organizations and private companies all the way up to large municipal organizations--there seems to be little control exercised over who sits behind the wheel of an emergency vehicle.

Emergency Vehicle Operators were identified as a part of a driver information system owing to the unique information requirements demanded by such operations themselves, not because there has been any move in the direction requiring special licenses or tests. Critical information requirements for Emergency Vehicle Operators include the following topics:

- Authorized violation of traffic regulations including speed limits, traffic signals, rules of the road, and parking regulations.

- Required warning signals and devices.
- Vehicle handling characteristics and precautions.

Information related to activities other than actual vehicle operation would fall outside the scope of a driver information system.

Recreational Vehicles

The past ten years have witnessed a marked increase in the numbers of travel trailers, campers, and motor homes operating on the public highways. At the present time, no State requires special licenses for the drivers of these Recreational Vehicles. While there are no data indicating that Recreational Vehicles pose an unusual safety hazard, there is evidence that many Recreational Vehicle accidents result from characteristics of the vehicle and the driver's unfamiliarity with them. Information that might be helpful in preventing accidents would include the following topics:

- Vehicle handling characteristics including turning, stopping, and susceptibility to cross winds and air turbulence.
- Load limitations and load distribution requirements.
- Braking techniques including jackknife prevention.
- Overhead clearance requirements.
- Tire inflation and care.
- Fire prevention, including engines, stoves, heaters, refrigerators, and storage tanks.
- Vehicle equipment including lights, mirrors, and fire extinquishers.

CHAPTER III

INFORMATION DISSEMINATION SYSTEM

The most important part of the driver information system pictured earlier in the Guide is that portion of it concerned with information dissemination, that is, the system used to "get the word out." Tests are, of course, necessary and important. However, as far as this Guide is concerned, their primary function is to support information presentation, that is, to motivate people to acquire the information and to make sure that they have it.

This chapter will focus primarily upon manuals. The printed manual has been, and no doubt will continue to be, the primary method of disseminating information. In some cases, it will be the only method. Compared to other ways of spreading the word, the manual is:

- Inexpensive--It generally costs only 25 to 50¢ to reach each driver.
- Accessible--Drivers can pick up a manual at any time they need it or want it.
- Self-paced--Drivers can read a manual at their own pace and review it as often as they want.

The following sections will provide suggestions as to the content, format, and style of manuals. It will also describe a set of manuals that were prepared using these guidelines. The chapter will include a section on other approaches to the dissemination of driving information.

CONTENT OF MANUALS

The most important characteristic of any manual is what it contains. The most beautifully written and most eye-appealing manual in the world is almost useless if it doesn't contain the right information. Look at the telephone book. It is far from the most attractive document ever published. Yet, it is probably the most widely read. Why? Because it contains information people want. A driver manual functions in a similar way. Drivers don't read it to be entertained. They read it to get information needed to pass a test.

Appropriate content areas for each of the manuals were outlined in the last chapter. Detailed subject matter for each of these topics can be obtained from the following general sources:

- Driver education textbooks.
- Informational and educational materials available through colleges and universities, driving-related organizations such as American Automobile Association, and the National Safety Council.

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- The manuals that were prepared in the Driver Manuals Project.

There exists a great volume of information pertaining to each of the topics that were listed in the last chapter. Each item of information being considered for inclusion in the manual should be evaluated against the following three questions:

Does the applicant need it?

Can the applicant understand and apply it?

Can the applicant remember it?

Does The Applicant Need It?

Just because a particular topic represents an "information need," it doesn't follow that everything pertaining to that topic is also needed. Each individual item of information needs to be judged on the basis of its ability to help or encourage drivers to operate more safely. There are several kinds of information that seem to creep into driver manuals even though they do not meet this standard. Some of the more common examples are the following:

- Descriptive Information--Many driver manuals contain information that's purely descriptive. The information describes places, things, or organizations, apparently for no other reason than the fact that they exist. This information may be interesting, but it does not help the applicant to drive any better. For example, several State drivers manuals provide several pages of highway signs. The signs aren't explained, indeed, they don't need an explanation; they are just illustrated.

- Definitions-- It is important that applicants know generally what terms used in a manual mean. However, some manuals go into paragraphs and even pages of pure definition. It may give the applicant an excellent understanding of what certain terms mean to the licensing agency. However, it is difficult to see how much such an understanding improves driving.

- Concepts--Some scientific and technical concepts can aid understanding. However, many of the concepts introduced in manuals don't appear to serve this function. For example, drivers can probably understand the relation between number of drinks and driving impairment without knowing about "blood alcohol level."

- Available Information--Some of the information drivers need is available to them at the time they need it and doesn't really have to be in the manual. For example,

speed limits are generally posted on highways and interstates. Most parking restrictions are indicated by signs or curb markings. There is little need for drivers to memorize this information.

Can The Applicant Understand and Apply It?

Information doesn't do drivers much good if they can't understand it. Many manuals contain some sections that are impossible for the average driver to understand. Sometimes the problem is simply writing style; that problem will be discussed in a later section. Sometimes, however, the problem is with the information itself.

When it comes to inherently incomprehensible information, traffic laws head the list. A case against use of driver manuals for publicizing traffic laws was made in the introductory chapter. Nonetheless, there seems to be a feeling in some quarters that the best way to keep ignorance of the law from being an excuse is to reproduce the law in the manual. This view has several shortcomings.

- No manual can cover even a substantial minority of traffic laws. What ends up in the manual is usually rather arbitrary.
- Laws are generally written in terms that are hard for the average driver to understand. Many are still ignorant of the law after reading the manual.
- Even when laws are intelligible, they are often expressed in terms that make them hard for a driver to apply. For example, they often require drivers to judge distances in feet.

It is usually possible to formulate a safe driving practice that meets both the letter and spirit of the law, while at the same time being relatively easy to understand and apply. Take for example a law requiring use of headlights "one-half hour after sunset." How does a driver know how long ago the sun went down if it is a cloudy day? Simply telling the driver to turn on the headlights when it becomes hard to see other cars will meet the legal requirement with a rule that is easy to apply.

None of this should be taken to mean that laws should not be mentioned. It is important that drivers know where safe driving practices have the status of law. The objection is to making the drivers manual a manual of laws.

Can The Applicant Remember It?

Some of the information in a manual is intended for reference pur-

poses. Most of it, however, is supposed to be remembered. This is certainly true of information concerning driving. To be of any use, it must be in the driver's head, not in the glove compartment.

Many manuals contain sections of technical detail that can't possibly be remembered. In most cases, with little ingenuity, the information can be summarized in a form that will allow it to be remembered.

Some of the more common examples of unnecessary, "immemorable" detail are the following:

- Stopping Distances--Many driver manuals contain tables which show stopping distances at various speeds. There is no reason why the distances must be learned. The only real purpose the information serves is to show drivers how speed must be adjusted to available stopping distance. This can be done by picking a couple of speeds and expressing distances in approximate terms, e.g., "at 50 mph it takes a half a block to stop."

- Blood Alcohol Levels--Many manuals provide complex tables showing blood alcohol level as a function of both number of drinks and body weight. A simple statement of how many drinks it takes persons of light, medium, and heavy weights to reach a level of intoxication would suffice.

- Turning Lanes--Some manuals take several pages of diagrams to describe the proper turning path of travel for turns at various kinds of intersections. All drivers really have to remember is to start from the lane closest to the direction they want to go, and drive into the nearest travel lane.

- Passing Limitations--Passing regulations are typically described in terms of combinations of solid and dashed lines. It all boils down to one rule: "A solid line on your side of the road means you can't pass; a dashed line on your side means you can (if the path is clear)."

ORGANIZING CONTENT

The typical drivers manual will not impress anyone with its organization. No two manuals follow the same organization. An inspection of the Table of Contents rarely indicates any logical pattern. Two factors excuse the relative lack of organization. First, because it is relatively short, organization is not the problem it might be in a larger volume--such as a driver education textbook. Secondly, since there is little sequence to driving itself, there is no particular organization inherent in most of the content.

Despite all this, there are a few principles that can be applied to organization of manuals.

Sections

People rarely read a manual from cover to cover. Rather, they are inclined to open it at random and hopscotch about. To facilitate this "random access," manuals should be organized into relatively short, bite-sized sections of two to three pages each. Applicants are more likely to embark upon a section that is relatively short and, having started, will be more likely to finish it before putting the manual down. Each of the sections should be self-contained, not requiring prior information from other sections.

Access To Information

Drivers should be able to find the information they want easily and quickly. The larger manuals should have either a highly detailed Table of Contents or an alphabetized Index, or both. Information that is likely to be used frequently, for reference purposes, should be separated from that which it is expected the applicant will read for comprehension. In a manual for New Drivers, the information most likely to be referred to is that pertaining to licensing procedures. It is helpful if this information is placed in the front of the manual where it can be found without a great deal of page-turning.

Use Of Principles

Because space in a manual is at a premium, it is important that information be organized as efficiently as possible. One way of doing this is to formulate general principles to encompass a lot of specific information. Driving lends itself to such compression. Most driving activities can be covered by a limited number of principles. A good example is signalling. One State driver manual described use of turn signals on 13 different pages, in connection with entering the roadway, turning at intersections, entering and leaving freeways, changing lanes, and passing. One simple principle--to signal whenever you intend to change position on the road--would encompass all situations. Several principles can be formulated to cover use of mirrors, adjusting speed to conditions, keeping distance from other vehicles, and other driving activities.

STYLE

The style of the manual should support its use. It is helpful if it can be attractive, too. However, eye appeal must take a backseat to function.

Writing Style

Applicants should not be held responsible for information they cannot understand. The manual should be written simply enough for drivers of "normal" reading ability to comprehend. It helps if the information is simple to begin with. Traffic laws are inherently incomprehensible to a large segment of the general population. But, once the information has been simplified, it must be written simply.

The fifth to sixth grade reading level is a good one at which to pitch a drivers manual. The great majority of license applicants can read at this level. Anything simpler approaches a "see Spot run" level, which adds greatly to the length and cost of the manual as well as the frustration of good readers. Alternative approaches will be suggested for those who cannot cope with the fifth grade reading level. The next page provides a list of guidelines for improving the readability of manuals.

The average reading level of the manual, as a whole, should not exceed 6.5. It is all right if some of the samples go as high as the seventh or even eighth grade; not everything can be cost-effectively expressed at a fifth and sixth grade level. Also, remember that many driving terms are familiar enough to be recognized by people with limited general reading ability. Therefore, the reading level may not be as high as the reading level index says it is.

The reading level of the manual should be checked by taking a number of pages and calculating the average number of syllables per 100 words and the average number of words per sentence. The table on the next page may be used to measure the reading level.

Illustrations

It isn't very often that "a picture is worth a thousand words." However, illustrations can be used to communicate information that cannot be well expressed in word form. Judicious use of illustrations greatly enhances the ability of a manual to communicate information.

It is important to remember that while a picture may be worth a great many words, it also displaces a great many words. Illustrations should be required to pull their weight. Those that are used simply to beautify the manual may do the driver a disservice by crowding out important information. Remember, the scarcity of pictures in dictionaries does not discourage their use.

Perspective

The perspective shown in an illustration should be as realistic as possible. Drivers of limited mental ability sometimes have difficulty shifting perspective.

If information relates to what people should do while driving, it

READABILITY GUIDELINES

The following guidelines should be used in preparing all materials intended for general consumption. They should be applied at all stages of preparation, including developmental evaluation, pilot testing, and final product development.

A. Word Level

1. Syllable count should be kept low (below 135 syllables per 100 words).

2. Multi-syllabic words should be avoided where possible (e.g., "car" for "automobile," "crossroad" for "intersection").

3. Technical terms, legal vocabulary, and other complicated expressions should be avoided to the extent possible (e.g., "arrested" for "apprehended," "speed up" for "accelerate").

4. Abbreviations should be avoided except where commonly understood (e.g., "amount of alcohol in the blood" rather than "BAC").

5. Contractions should be avoided where possible ("will not" instead of "won't").

6. Common everyday words should be used wherever possible ("know about" instead of "keep abreast of").

B. Sentence Level

1. The length of sentences should be kept to a minimum (9-10 sentences per 100 words).

2. Complex and compound sentences, relative clauses, and embedded sentences should be avoided.

3. The active voice should be used instead of the passive voice wherever possible.

C. Paragraph Level

1. Ideas should be stated as clearly and directly as possible.

2. Examples should be given where they will aid understanding.

3. In general, one paragraph should be used for each important idea.

D. Overall Organization

1. Titles and subtitles should be used liberally to facilitate comprehension of structure and flow of ideas.

2. Heavy print, italics, or underlining should be used to highlight important ideas and words.

3. Each section will be introduced with a paragraph that will establish purpose and identify organization.

4. Each section will be closed with a summarizing paragraph.

5. Appropriate visuals (e.g., photos, diagrams, artwork) should be used wherever such will aid understanding.

E. Measuring Reading Level

Typical Average Number of Syllables per 100 words	Grade Level of Writing	Typical Average No. of Words per Sentence
120 or fewer	1st	7 or fewer
120 - 121	2nd	7.0 - 9.0
121 - 123	3rd	9.0 -11.5
123 - 124	4th	11.5 -13.3
124 - 126	5th	13.3 -14.3
126 - 129	6th	14.3 -17.2
129 - 137	7th	17.2 -20.0
137 - 142	8th	20.0 -20.8
142 - 149	9th	20.8 -22.2
149 - 153	10th	22.2 -23.2
153 - 158	11th	23.2 -23.5
158 - 162	12th	23.5 -24.4
162 - 169 or more	College	24.5 or more

To determine the readability level use a ruler to line up the number of syllables per 100 words and the average number of words per sentence. The ruler will cross the grade level of writing at the appropriate grade.

should be presented from the driver's view point. Of course, if the illustration involves the relation of the car to things behind or beside it, it will be necessary to move outside of the car. Here, realism should be maintained through a ground level or slightly elevated perspective. A purely diagrammatic "view from the top" can be difficult to interpret and should be avoided if possible.

Detail

Illustrations should provide only as much detail as is needed to convey needed information. Too much detail can be distracting. Photographs are useful where realistic detail is needed. A photograph lets the reader know what something is really going to look like. It is also useful in finding out if the reader can pick out important detail. However, photographs can be tricky; they may give you detail you don't want. They have to be checked carefully to make sure they don't end up misinforming the reader.

Color

Many drivers manuals make lavish use of color. There is no doubt that color spruces up appearance. It is also expensive; it can double the cost of a manual. If the budget is limited, the added cost may be taken out of the number of pages. In such instances, color should only be used where necessary, that is, where it is part of the information to be presented. Illustrations of traffic signals, signs, and lane markings all benefit from the use of color. Three colors--red, yellow, and green--will handle the most important of these needs. Generally, the manual can be configured so that colors are confined to a limited number of pages, thus minimizing the added cost.

ALTERNATIVE INFORMATION DISSEMINATION SYSTEMS

A sizeable segment of the driving population in any State consists of people who cannot read well enough to use a written manual. Some drivers are completely illiterate. Others can read but not well enough to handle material written in a fifth to sixth grade reading level. No one knows how many drivers fall in the "reading disabled" category. However, the fact that between 10 and 20% of license applicants request an oral exam provides an inkling.

When applicants can't read well enough to take a written test, they are generally given an oral examination. But how can they prepare for the exam if they can't read the manual? Many are fortunate enough to have someone who will read it to them. But what about those who don't? The more comprehensive State manuals become, the more they will include information that isn't common knowledge among drivers and the more important it will be for applicants to be able to prepare by reading the manual. And, the more important it will be for the State to provide some alternative system for disseminating information.

Requirements Of An Alternative Information Dissemination System

At first glance it might seem that all the non-reader needs is to have the manual read aloud. A phonograph record or tape cassette would do. There are a couple of reasons why this won't work.

First, people who read don't proceed through a manual on a word-by-word basis. Before they read a passage, they often preview it; they glance ahead to size up the general organization and content. As they read, they occasionally review what they have read. They go back over things they don't understand or things they want to lock in. Simply reading the manual aloud doesn't allow the non-reader to duplicate what the reader does. Secondly, many of the people who can't read also have trouble listening. Their problem is really words in any form. They have trouble translating between actual driving and verbal symbols, whether those symbols are written or spoken.

This section will discuss some of the more important ingredients of an information dissemination system for non-readers.

Pictures

One way of overcoming the problem that many non-readers have with words is by providing a pictorial representation of the information. Since most of what a driver does is determined by what he sees, pictures can play an important part in relating safe driving practices.

While a picture may be easier to grasp than a word, it is still a symbol. The more the picture resembles the real thing, the easier it will be to interpret. Where information involves motion--as a lot of driving information does--it is best if the picture also shows motion. If the information involves a car turning left, the picture should show a car turning left. A still picture of a car in the middle of a left turn isn't the same thing.

Preview and Review

An alternative presentation system should provide an opportunity for preview and review just as the manual does. Obviously, a manual has greater freedom in this respect. However, any alternative approach can and should contain previews of each major section as it is undertaken and a review after it has been completed. The review should include both the sight and sound portions of the presentation.

Comprehensiveness

The applicant who views an audiovisual presentation is entitled to the same information that is provided in the manual. After all, he is going to take the same test. The thought of having to include in an audiovisual presentation every scrap of information that is in the driver manual may

seem a horrifying prospect. A large volume of detail is typically considered inimical to an interesting audiovisual presentation. However, the object is not to design an interesting audiovisual presentation but rather one that prepares the applicant for a test.

A system for disseminating information consists of two parts: the system that presents the information to its recipient and the system by which the presentation is delivered. The next two sections will describe prospective presentation and delivery systems.

Alternative Presentation Systems

A variety of presentation systems are capable of meeting the general requirements just described. Drivers with reading disabilities can learn through the audiovisual approach outlined by these requirements. In fact, in a pilot test conducted as part of the Driver Manuals Project, they learned almost as much as drivers without reading disabilities learned from a manual. Since they knew less when they began, their final level of knowledge was lower. However, the gain was just about the same.

Unfortunately, since no State has attempted to mount a full-fledged information program for non-readers, there isn't enough experience with any system to offer recommendations, or even describe with certainty the strengths and weaknesses of each approach. The comments that are offered here are based solely upon the known characteristics of each system.

"Talking Book"

This system consists of a picture book accompanied by a narration on record or audiotape. Its primary advantage is its economy, particularly when it uses inexpensive disposable plastic records. The "talking book" is the only one of the presentation systems to be described that is inexpensive enough to be placed in the hands of the applicants.

The "talking book" is also advantageous in dealing with foreign language groups. Limited numbers of tapes or cassettes can be prepared in different languages to meet the needs of foreign speaking illiterates, as well as those who are literate in a language not covered by a manual.

There are two major disadvantages to a "talking book" approach. First, the use of still pictures limits the effectiveness of the presentation. Many safe driving practices are difficult to communicate to individuals who have limited reading ability without the use of motion. The second disadvantage is the equipment needed for the audio presentation. Not everyone has it. Unfortunately, people who can't read are among the most likely not to have it. And, license agencies may be understandably reluctant to undertake the burden of renting or loaning it.

Slide/Filmstrip-Tape Presentation

An increasingly popular audiovisual presentation involves a slide or filmstrip presentation controlled and narrated by an audiotape. Its strengths and weaknesses parallel those of a "talking book." The use of film instead of hard copy visuals allows more economical reproduction of color as well as simulation of motion through rapid presentation of successive frames. On the other hand, the need for fairly expensive equipment means that drivers must come to the presentation system rather than vice versa.

Motion Pictures

Because of its ability to depict motion, a motion picture film is probably the most effective medium for communicating with drivers who cannot read. The equipment it requires--a motion picture projector--while expensive, is widely available.

The primary liability of motion picture film as an alternative system for presenting driver information is the large production cost. It exceeds that of other alternatives by a factor of ten or more. Moreover, the fact that the sound track is on the film itself makes it extremely expensive to prepare different audio presentations for drivers who speak foreign languages.

Multimedia Presentation

One of the inefficiencies of motion picture film is the fact that it takes 24 frames per second just to show a still picture. A presentation system that could stop when the picture stops and go when the picture goes has potential cost-effectiveness.

Thus far, the realization of this potential has been largely stymied by the equipment requirements. The common multimedia system consists of a motion picture camera and slide projector with a device that switches back and forth between the two. The arrangement has been expensive, cumbersome, and sometimes unreliable.

More recently, attention has turned to a single motion picture projector that can be stopped and started for still and moving pictures. The system is essentially the same as a slide/tape presentation except that the audiotape is connected to a motion picture projector. The fact that the audio and visual presentations are separate means of reduction in production costs as well as the ability to prepare different audio presentations for various foreign language groups.

Alternative Delivery System

Unlike manuals, the various presentations that have just been

described cannot simply be handed to drivers. Each requires some kind of mechanism for delivery and presentation. These mechanisms can be divided into three categoris:

Individual delivery

Group delivery

Mass delivery

Individual Delivery

In many communities, the equipment needed for the various alternative presentations is available through public libraries, school libraries, school learning centers, and other public agencies. The equipment on hand in such agencies includes cassette audiotape players, slide-tape equipment, videotape playback equipment, and individual Super 8 motion projection systems. In the case of cassettes, some libraries will loan them out. If availability of the necessary hardware could be assured throughout the State, the licensing agency could distribute or sell at cost copies of an audiovisual presentation to be made available to individuals desiring to prepare for their license examination.

Where space permits, the equipment and materials that are needed might be available at license stations. Where presentations are relatively short, they could be conveniently viewed just prior to administration of the corresponding test. Longer presentations such as one covering the content of a basic drivers manual, would probably require at least two trips.

Group Delivery

If demand becomes great, as it might in larger cities, group presentations may be needed to replace or lessen the burden upon individual delivery mechanisms. Presentations could be delivered through schools or other community organizations concerned with the reading disabled. Those whose problem is simple inability to read will probably only have to view the presentation once. However, those whose reading difficulty is a manifestation of a deeper learning problem may require two or even three presentations. A technique used with educable mentally retarded students in the Driver Manuals Project was to show a protion of the presentation twice and follow it with a group discussion.

Following completion of the entire presentation, an oral test could be administered on a group basis. This would be a convenience to the applicants and would yield a considerable savings in examiner time over that of individual oral examinations at a license office.

Mass Delivery

The audiovisual presentation might be delivered through the medium of television, either by educational television stations or through commercial stations during hours generally reserved for educational programming (i.e., early morning). The success of a mass media delivery would depend on the publicity the presentation received through the licensing agency, organizations catering to the reading disabled, or public media.

Use of mass media is obviously not limited to the preparation of drivers for license tests. Radio and television have, since their inception, provided public service announcements concerning various aspects of safe driving. On the whole, the informational content of such announcements has been rather slim and their scheduling has tended to confine their benefits to insomniacs. The quality of information disseminated might be substantially improved through the involvement of licensing agencies. However, whether this is an effective use of licensing resources is a question. Anyone can sponsor highway safety messages. The special advantage of licensing agencies is their authority to hold drivers accountable for obtaining information. Can this authority be exercised where the source of information is no more reliable than public service announcements? Because of the doubts rainsed by this question, mass media delivery is not considered appropriate for inclusion in a driver information system controlled by licensing agencies.

CHAPTER IV

INFORMATION ASSESSMENT SYSTEM

The primary purpose of a test, as far as this Handbook is concerned, is to motivate license applicants to learn the information that is in the driver manual and to make sure they have done so. It isn't to keep bad drivers off the roads; most of the applicants who fail the test the first time will ultimately pass. And, it isn't to help drivers find out what they don't know; there aren't enough items for that.

This chapter will discuss the construction of knowledge tests for driver licensing. It isn't a treatise on psychological testing. Rather, it is an attempt to provide some practical guidance in ways of preparing tests so that they do a better job of making sure that drivers have the information that they need in order to operate safely. The guidance will cover selection of content, preparation of items and construction of tests. The final section will discuss special methods of testing applicants who do not read well enough to take a written test.

SELECTING TEST CONTENT

If a test is going to induce drivers to read the manual and is to assess how well they've done so, then the test questions should come completely from the manual. More and more States have come to require that written examinations be confined to information that is available from the State drivers manual. One reason for this restriction is the belief that the State cannot legitimately hold its citizens responsible for information without having first provided them a means of getting it.

In addition to helping the test serve its intended purpose better, taking test questions entirely from the driver manual has another advantage. It establishes the manual as the official source of test answers. Applicants will not always agree with the "correct" answer. Why should they? Even the experts don't agree all the time. If test questions are drawn completely from the manual, applicants will at least know what answer will be considered "correct" on the test. Having available a documentary source for all test questions is also something almost certain to be appreciated by examiners.

Criticality of Information

While a test should assess an applican't knowledge of the driver manual, it is not necessary to include everything that is in the manual. The test should be confined to that information that is most critical to safe vehicle operation. Even the best manual will contain some information that is not critical. The following are examples of kinds of uncritical information often found in a driver license examination:

- Definitions--Hopefully, few definitions will appear

in the manual. Those that do appear need not be repeated on the test. If knowing the meaning of a term is important to safe driving, it should be possible to formulate a question requiring the applicant to apply the definition of a term rather than simply repeating it.

- Explanatory Information--Some of the information in a manual is there only to explain, to help the reader understand some point. For example, a flashing red traffic signal may be explained in terms of its similarity to a stop sign. If the purpose of information is simply to aid in understanding, there is no need to hold drivers accountable for it. Any question about a flashing red signal itself should deal with its own meaning, not its similarity to a stop sign.

- Detail--As a general rule, test questions should not involve any more detail than is necessary for safe driving. For example, a test question that requires identifying stopping distances to within an accuracy of 25 feet is much too detailed.

Representative Sampling

A test should form a representative sample of the information in the manual. The purpose of the test is not, after all, to see whether the applicant knows the answers to the particular questions on the test. Rather, it is to provide an estimate of how well the applicant has mastered everything that is in the manual. If this purpose is to be served, the test must sample representatively from the manual. Here are some of the factors that affect the representativeness of the test as a sample of the driver's knowledge:

- Breadth of Coverage--Questions should be taken from all sections of the manual. The applicant should understand that anything in the manual has a chance of being on the test. If the applicant knows that certain information will not be on the test, he won't give it much attention.

- Level of Difficulty--Test questions should represent all levels of difficulty from very easy to very hard. Some books on testing suggest dropping questions that almost everyone gets right. It could result in whole sections of the manual being omitted from the test. It's a little like suggesting that food inspectors stop checking particular products just because they've passed previous inspections.

- Sample Questions--Many manuals have sample questions

to allow applicants to test their own knowledge. There is nothing wrong with the same information or even the same items showing up on the test, so long as they were obtained through a representative sampling of manual content. However, if an effort was made to include a number of practice items on the test, or worse yet, if the test is entirely restricted to the information in practice items, the results won't give a very good indication of how well the applicant has mastered the manual as a whole. Indeed, most applicants who know anything about the test will ignore the manual and just study the practice questions.

PREPARING ITEMS

The purpose of a test item is to see whether or not an applicant has a particular piece of information. The items should be constructed so that those who have the information will answer correctly and those who do not have it will answer incorrectly (unless they happen to guess right). Aspects of a test item that affect its ability to fulfill this goal include the type of item used, the nature and number of alternatives, the way the item is written, and use of illustrations.

Types of Items

The multiple-choice style of test item is so commonplace that it has become a coin of the testing realm. Its preimary virtue is the ease with which multiple-choice tests are administered and scored. Considering the hundreds of applicants that pour through an examination station in a day, this feature is paramount. Another advantage is familiarity. Almost all applicants have had previous experience with the multiple-choice type of item. The guidance offered in the rest of this chapter will apply largely to multiple-choice items. However, several alternative approaches have been used in license testing and warrant some discussion.

Matching Questions

This type of question provides a list of questions and answers. The idea is to match each question with its corresponding answer. It works only for a series of questions dealing with the same type of information, for example, traffic signals and signs. In such cases, one matching question is more efficient of space and testing time than the number of multiple-choice items that would be required. However, unless a test is quite long, say 50 items or more, it is rarely feasible to devote a series of questions to one type of information. Ten questions on signs and signals on a 20-item test could hardly be called representative sampling.

True-False Questions

The problem with the true-false question is that it tells as much about what an applicant means by "true" or "false" as it does about his knowledge of answers to questions. The meaning of "true" can range from "more true than false" to "true beyond a shadow of a doubt." Applicants who hold the latter interpretation will call a generally true statement false if they find a single exception. This often works to penalize the truly knowledgeable applicant. This difference of interpretation, coupled with the fact that an applicant has a 50-50 chance of answering correctly, should discourage the use of true-false questions. With a little effort, a true-false question can be turned into a multiple-choice item.

Recall Items

Multiple-choice test items can only assess the ability to recognize the correct answer, not the ability to recall it. A test of recall is clearly a more valid measure of knowledge as it is needed in driving. Measures of recall include short essay, sentence completion, and fill-in items. The major liability of recall items in a license setting is their dependence upon subjective scoring, which is non-uniform and time consuming. While both problems can be partly overcome through the use of objective scoring criteria, a subjective scoring system imposes an administrative burden where large numbers of applicants are involved.

A second obstacle to the use of recall items is their susceptibility to variation in interpretation by applicants. It is possible for an applicant to provide an answer which is correct as he understands the question, but which is not the one the examiner is looking for. This is prevented by the limitation in answers in a multiple-choice test. It almost takes an oral administration of any subjective test to overcome the problem of interpretation.

Situational Items

Tests should do more than simply assess an applicant's recall or recognition of the information in the manual. It should also test the ability to apply information in traffic situations.

A good manual will set forth a number of general principles that will enable drivers to make good decisions. The test should not only assess the drivers recall for the principles, but the ability to apply them to traffic situations and make sound decisions. Situational test items can be formulated in a multiple-choice format.

Because they involve decisions, situational items often tend to be controversial. When controversies arise, an examiner can refer a disgruntled applicant to those sections of the manual where a principle is formulated and explain the rationale by which the "correct" decision is reached. However, the decision itself cannot be documented in the manual.

Because of the contention they evoke, and the inability to cite the manual as an authority for answers, States have tended to shy away from situational items, and some States that have used them in the past have abandoned them. In doing so they may have solved a public relations problem at the expense of valid testing.

Alternative Responses

The quality of a multiple-choice test item lies primarily in the incorrect answers, that is, the "distractors" or "foils." They must be incorrect, yet sufficiently plausible that only an applicant who knows the correct answer will be able to reject them. What follows is a set of principles which may be applied to the selection of distractors to overcome some of the problems that have afflicted license tests in the past.

Distractors Should Be Incorrect

An applicant in defending an answer is occasionally told that his answer is correct but it is not the "best" one. It is often difficult to find distractors that are plausible and not at least partly correct. The trouble with this approach is that "best" is often a matter of opinion. Even if the opinion is correct, there is often nothing in the manual that communicates this to the applicant.

All Alternatives Should Deal With the Same Piece of Information

It is not uncommon to find items in which the various alternatives deal with essentially different information. It generally reads something like "which of the following statements is true?" followed by several independent statements all of which deal with different items of information. The question is really several different questions. Unless all of the distractors are covered by the manual, the applicant has no way of knowing whether one of them is correct or not. And, if the applicant gets the question wrong, it is hard to say what he knows and what he doesn't know.

All Purpose Answers and Buzz Words Should Be Avoided

The correct answer to a question is often some generally acceptable response such as "steer firmly" or "inspect regularly." These terms are so commonly applicable that any moderately astute applicant can recognize them as correct, whether they have read the manual or not. A test becomes one of intelligence rather than knowledge. Close to the "all purpose answers" are the safety "buzz words," such as "carefully" or "alertly." Words like these attract attention even if they are attached to the wrong answer. A person who really knows the correct answer probably won't be distracted, but someone who is unsure will be influenced.

Avoid the Catch-All Answers "All Of The Above" and "None Of The Above"

The phrase "all of the above," when it is the correct answer, presents the applicant with alternatives that are all correct. Many applicants will select the first alternative without looking further. They end up getting the wrong answer even though they are right. The phrase "none of the above" is just as bad. Since the applicant cannot be sure any answer is correct, he is in the position of having to decide upon the truth or falseness of each alternative, rather than simply distinguishing between the correct and incorrect answers. It suffers from the same general response bias as a "true-false" question.

Number of Alternatives

The use of four alternatives--a correct answer and three distractors--has become almost convention. If three plausible distractors can be found for each item, a four-alternative format is probably the best. More alternatives would simply add to the length of the test without appreciably decreasing one's chances of guessing the correct answer.

In an item dealing with driving, however, it is frequently difficult to generate three plausible distractors. The third distractor is either so far away from the correct answer that no one chooses it or so close to the correct answer that is almost correct. There is no point in adding a third distractor simply to have a four-alternative format. The third distractor does not reduce the chances of guessing correctly if no one picks it. It simply adds to the length of the test.

Because of the difficulty they have found in generating three acceptable distractors, many States have changed from a four-alternative to a three-alternative format. This practice has been employed in the tests that were developed in the Driver Manuals Project. It is recommended that States either employ a three-alternative format (one correct answer and two distractors) for all items or confine the four-alternative format to instances where three plausible distractors can be generated.

Wording Of Items

The wording of test items should communicate questions and answers clearly without giving away the correct answer to drawing undue attention to any one distractor. The following guidelines may help in preparing items that meet this condition:

- Vague or Ambiguous Words Should Be Avoided or Clarified--Make sure that words have only one meaning. A term such as "three lane road" may be interpreted by some to mean three lanes proceeding in the same direction, rather than two lanes in opposite directions and a shared middle lane.

- Questions Should Be As Short As Possible and Consistent With Understanding--If any portion of the question must be long, it should be the lead, not the alternatives.

- Complex Terminology Should Be Avoided--The items should test the applicant's knowledge, not verbal skill. The most common use of complicated terminology arises with questions having to do with laws. The questions should be simplified to call for understanding and application of the law rather than the sheer ability to read it. This should be done regardless of how the information appears in the manual.

- The Use of the Negative Form Should Be Avoided--A question that begins with "which of the following is NOT" requires the examinee to seek out an incorrect answer. Many examinees tend to forget that they are looking for an incorrect answer and will select a correct answer, regardless of the emphasis that is given to the negative term.

- The Alternatives Should Be of Approximately the Same Length-- Any inordinately long alternative tends to attract attention. They are most likely to arise when an attempt is made to use the exact phraseology as employed in the manual.

- Critical Words Shoud Be Emphasized--Any word that is critical to the interpretation of a question should be emphasized. In a word involving a flashing red light, the word "flashing" should be emphasized or examinees will tend to overlook it.

- Avoid Justifying Distractors--Sometimes an attempt is made to improve the acceptability of a distractor by giving it a plausible sounding explanation. The explanation may sound so plausible that examinees accept it even knowing what the correct answer is.

Use of Illustrations

The same general guidelines that were applied to the use of illustrations in manuals should extend to their use in tests. They should be employed whenever they help to communicate. Some questions will benefit greatly from illustrations, for example, those of a situational nature. Others will not.

There has been an increasing tendency toward the use of illustrations for every question on a license test, even though the great majority of of questions do not need an illustration and a great many draw no benefit

whatever from one. This universal use of illustrations may be in part a result of favorable public reaction to the illustrations which appear in most automated testing systems. However, in an automated testing system the additional cost of illustration is negligible. Using projection equipment, large color illustrations can be provided at little more expense than the cost of the text.

The situation is far different when the test is presented in hard copy. If the illustrations are made large enough to be legible, they will generally double, triple, or even quadruple the physical size of the test. What sometimes happens is that, in order to economize, the test is shortened or the illustrations are reduced in size to a point where important detail is lost. The ability of illustrations to serve where they are needed is then lost in order to provide them where they aren't needed.

CONSTRUCTING THE TEST

The construction of a test, once items have been prepared, involves assembling them into a suitable format and preparing alternate forms.

Test Format

The following is a list of suggestions for test format.

- Arrange Alternatives In a Logical Progression--If there is any logical progression to the alternatives, it should be preserved in the test. If the answers involved numbers, they should be listed in numerical order. This makes the alternatives easier to read and lessens the chance of mistake.

- The Position of the Correct Answer Should Be Determined Randomly--Unless the position of the correct item is randomly determined, it is almost impossible to avoid over-use of one position or falling into a particular pattern. A single die may be used for three-alternative questions; two coins may be used for four-item alternative questions.

- Questions Should Be Independent of Each Other--No question should require information from another question in order to be answered, nor should any question provide information that may be used in answering another question.

- Complete Instructions Should Be Provided--The test should provide instructions on how to answer questions, what to do when the test is completed, and whom to consult if problems arise. At least one sample question should be provided. It should consist of information the examinee is almost sure to know, so as to test

understanding of instructions. To allow the applicant to check on his understanding, the correct answer should be provided.

- Avoid Answer Sheets--Applicants who are not used to separate answer sheets often have difficulty with them and end up marking the right answer in the wrong place. Selected answers should be checked or circled in the test booklet.

Test Length

How many questions should a test consist of? States vary considerably on their tests for license applicants, some containing as few as 20 questions and some as many as 50. In most States, test length has been determined by such practical considerations as the amount of testing time available or physical limitations in the size of the test booklet or testing equipment. While these considerations are obviously important, the major issue in test length should be the number of items required to provide a reliable estimate of the applicant's knowledge. If a test is too short to provide a reliable estimate, then the test and the time it takes to administer it are wasted. And, if the test is far longer than necessary to provide a reliable estimate, time is also wasted.

The only way to find out how long a test has to be is by giving tests of different lengths and determining the reliability of each test. It isn't actually necessary to give tests of different lengths. A large pool of test items can be administered to one group. After its administration, the pool of items can be divided into "tests" of a given length. For example, a pool of 100 items could be divided into 5 tests of 20 items each. The tests could be scored and the reliability estimated. A method of estimating test reliability is provided in Chapter 5, EVALUATION. This estimate could be compared with estimates of reliability obtained from forms of 25, 33, or 50 items each.

Alternate Forms

Alternative test forms are indispensible to representative sampling of an applicant's knowledge. An applicant who has taken a test once will be sensitized to the information it covered when re-reading the manual and preparing for a re-test. Therefore, a re-test on the same questions would tend to produce a score that doesn't reflect the applicant's knowledge of the entire manual. If a re-test is to provide a representative sample of the applicant's knowledge, it must take place on an alternate form. The alternate form must represent an entirely independent sample of information. This means the questions must be different; they cannot be the original questions in a re-written form.

Number of Forms

The number of forms should be sufficient to be reasonably sure applicants will receive a different form on each re-test. If applicants are permitted to take the test three times, a minimum of three alternate forms is required. This, of course, assumes that the examiner has access to the applicant's record and can determine which tests have been administered earlier. If this isn't possible, then several forms (e.g., 5 or more) should be prepared to minimize the possibility that the same test will be administered on two occasions. In the Driver Manuals Project, seven alternate forms of the licensing tests were prepared.

Equality of Forms

Fairness requires that alternate forms be equal in difficulty. The chances of passing the test should not depend upon which form the applicant receives. However, there is an even more important reason than the fairness for requiring that alternate forms be equivalent. Each form is supposed to provide a representative sample of the applicant's knowledge. If each is successful, all forms must yield the same score. An applicant who knows 90% of what is in the manual should obtain a score of approximately 90% on each test. If applicants obtain different scores on the various forms then there is something wrong with the sampling process. However, the task is to make alternate forms representative, not just equal--after all, equality itself could be achieved by simply converting to standard scores.

A simple way to obtain representativeness relative to both level of difficulty and subject matter is to use the following procedure:

1. Rank order the test items in terms of their difficulty (percent passing) on the basis of post-test results as described in Chapter 5, EVALUATION.

2. Starting from the top, select as many items as there are forms. If there are five forms, select five items.

3. Assign the five items randomly to form, keeping track of which chapter or major section of the manual each item came from.

4. Draw the next five items and assign them randomly to form, with the restriction that items from a particular chapter be assigned to a form which has not already received an item from that chapter.

5. Continue down the scale of difficulty, selecting five items at a time. Assign items randomly to forms with the restriction that each chapter be represented on each form as nearly equally as possible.

6. Once all the items have been assigned to forms, determine for each form (a) the mean difficulty of the items, and (b) the distribution of items by chapter. Trade items among forms so as to render the forms as equal as possible with respect to content and level of difficulty.

Knowledge of Results

Knowledge of results is important to learning. This has led many in license testing to seek ways to inform applicants of their errors and to provide them the correct answers .

It is certainly desireable that applicants recognize their errors and not walk away from the examination station still harboring misinformation. Providing a brief explanation of the answers, or a reference to the portion of the manual where the answer can be found helps lend credibility to the test and becomes an asset to public relations.

While knowledge of results is desireable, it is far from being a necessity. After all, the purpose of the test is not to teach. The manual is supposed to do that. Providing answers to the questions on the test can only clear up a fraction of the applicant's misconceptions. What about all those that didn't happen to be covered by test items?

The manual provides answers to all questions, including those that didn't happen to be on the test the applicant took. Those applicants who do poorly should be referred back to the manual. Those who fail the test must, of course, do so since the next test they take will have different questions.

In short, giving answers to questions missed is a good idea if it can be done without taking a lot of time and without jeopardizing the security of the test. However, the major function of the test is to get applicants to read the manual; it is the manual that should supply answers.

Automated Testing

The last decade has seen the introduction of automatic license testing equipment in a number of States. While only a small fraction of license tests are administered by this equipment, the equipment in use is fully operational; it has gone well beyond the experimental stage.

In the automated testing systems most commonly in use, each test question, along with its accompanying pictorial, appears in a standard 35 mm color slide which is rear projected on a screen in front of the applicant. The applicant answers the question by pressing a button corresponding to the selected alternative. The response is immediately scored and correct answers (or errors) are entered into a counter. As the question is answered, a portion of the slide giving the correct answer is revealed to the applicant, often along with a brief explanation.

The applicant's score is either printed on hard copy, or totaled on a counter which is mounted on the equipment or on the examiner's station. Other types of automated test equipment have used computer generated and videotaped displays to present the questions. At least one system provided an oral presentation as well as visual presentation of the question.

The primary advantages claimed for automated test equipment are the use of pictorials, immediate feedback and automatic scoring. The use of pictorials was discussed earlier in connection with test illustrations. Let us briefly consider the other two features.

Immediate Feedback

A unique feature of automated test equipment is its ability to provide the correct answers to questions immediately. In a written test, feedback must be delayed to the end of the test, otherwise the applicant would change answers. The equipment prevents changing answers in an automated test.

How advantageous immediate feedback is, or whether it is an advantage at all, has never been evaluated. It is provided primarily because it is easy to do. Certainly, it satisfies the curiosity of the applicant. However, there are two potential disadvantages. The first is that is can slow down the test. In addition to the time required to read the answer, there is the time that may be spent mulling over an incorrect answer. Secondly, immediate feedback can adversely affect performance on the test itself. An applicant approaching the limit of incorrect answers may begin to feel a certain amount of emotional strain, like a basketball player in foul trouble. While the effects are uncertain, immediate knowledge of results cannot be claimed as an asset without further evaluation.

Automated Scoring

Unquestionably, automated scoring does save a certain amount of examiner time. In a large station, it could reduce the number of examiners required and, thereby, work an economy in staffing. Whether the savings in scoring time offset the procurement and maintenance cost of equipment has yet to be established. At least no cost-benefit analyses have been made public.

ALTERNATIVE INFORMATION ASSESSMENT SYSTEMS

Applicants who cannot read a written test generally have it read to them by an examiner. In some States, as many as a fifth of the applicants request an oral exam. In addition to those making such a request, there are probably another 10 to 20% who read, but not well enough to understand a written test. In many ways, the marginal

readers pay a greater penalty than those who cannot read at all, since they try to take the written test and end up doing poorly.

Oral testing, despite its prevalence, has several shortcomings:

- Time--Administration of an oral test is slow going. The examiner must read each of the items, often several times, and wait for the applicant to answer. During the time it takes to administer an oral test the examiner could process a dozen or more written examinations.

- Lack of Uniformity--If the questions are to be understood as well by the people taking the oral exam as they are by those taking the written test, the examiner may have to clarify them. It is often difficult to determine where clarification leaves off and coaching begins. Whether or not applicants pass an oral exam may therefore depend more upon who they draw as an examiner than how much they know.

- Information Storage--The literate examinee can review alternatives several times before choosing a correct answer. The subject of an oral examination is forced to store the alternatives mentally.

- Verbal Symbols--Spoken words are still words. Many of the people who cannot read are unable to handle verbal symbols whether they are written or delivered orally.

Requirements For An Alternative Assessment System

To help overcome the shortcomings of current oral testing, many States are developing alternative procedures of giving tests to reading disabled applicants. To be effective and economical, any system should meet as many of the following requirements as possible:

Content. The questions given on tests should be the same, regardless of differences in the way questions are asked. The number and content of the alternatives must be the same. The way the questions are worded may be changed somewhat to fit an oral delivery. It is also reasonable to give more questions dealing with sign recognition than would appear on a written test. Drivers who are allowed to take a special test because of their inability to read should not object to a few extra questions designed to tell whether their shortcomings will affect their ability to drive safely.

Pictorial Presentations. If reading disabled applicants are to have the same opportunity to evidence knowledge of the manuals as do those who read, they must be able to view all of the alternative answers simultaneously. If they are unable to read, then the alternatives must be presented pictorially.

Not all of the alternative responses to a driver license exam lend themselves to the pictorial presentation. However, it is almost always possible to generate some pictorial symbol that is capable of representing an alternative. After all, the purpose of the pictorial is not primarily to explain the alternative but rather to symbolize the oral examination so that it can be remembered while an answer is being selected.

Automated Presentation. To bring the expense of testing non-readers in line with that of written examinations, the presentation of questions may be automated. The oral presentation must be on a tape or record. If the pictorial presentation involves slides or films, it too must be automated.

Pacing. An automated test can be self-paced just as a written test is. The oral and pictorial presentations may be stopped, either automatically or by the applicant, and advanced when the applicant is ready to proceed. However, this is not necessarily an advantage. Many non-readers suffer from basic learning problems that handicap their ability to retain information. Once a question has been asked of them, time only works to their disadvantage. The question becomes more and more remote until it is forgotten completely. The test often grinds to a halt until the examiner intercedes.

The key to testing non-readers seems to be to set up the question in such a way that an immediate response can be obtained. A short time is allotted for the applicant's response--no more than 10 seconds--and the program continues. Fixed pacing generally benefits the examinee and prevents having testing equipment tied up for long periods of time.

Motion. The advantages of motion in pictures for non-readers were described in the last chapter. In a test, use of motion precludes the simultaneous presentation of the alternative responses. The examinee can't watch three or four motion pictures at one time. One solution is to present the question with motion and then resort to still pictures to portray the alternatives. While the alternatives are static, the fact that they were developed out of a motion picture aids in their understanding. This approach, however, requires the use of a split frame technique that is both costly and tends to limit the amount of detail that can be presented.

Another way of overcoming this problem is to display the alternatives in motion picture form but to present them sequentially rather than simultaneously. The question and the alternatives are presented a first time so that the applicant understands the options, and then a second time while one of the alternatives is selected. So long as the number of alternatives doesn't exceed three, this approach appears to work.

Alternative Approaches

Several systems have been used, operationally or experimentally, to test reading disabled applicants. They closely parallel the various systems used to present information. Again, the lack of experience in using these systems for licensing purposes limits what can be said about their advantages and disadvantages.

Printed Pictorials. The simplest presentation system, currently in use by one State, provides the applicant a booklet in which the alternatives to various questions are provided pictorially. The question is delivered orally by the examiner and the applicant merely points to the chosen alternative. While this system probably improves the validity of an oral test, it does not substantially reduce the time required of the examiner. All that would be necessary to overcome the latter objection would be to put the oral presentation on a tape or record, creating what might be called a "talking test." One State is currently studying this approach. Since the examiner is not present during the test, the applicant's answer would have to be registered in the test booklet. Because each question must be accompanied by three or four pictures, a "talking test" is somewhat more expensive than the typical written test. However, it is a lot more economical than an orally administered test.

Slide-Tape Presentation. Pictorial representations of the alternatives could be transferred to slides or film strips to use the type of presentation described in the last chapter. The advantage of this approach over a "talking test" is about the same as that of automated testing over written testing, namely, the ability to use automated scoring. Arrayed against this advantage is the fact that the pictorial display must be shared by three or four pictorials representing alternative responses. The amount of detail that can be provided is quite limited in comparison with that possible through printed copy.

Motion Pictures. Because of their ability to portray motion, motion picture films appear to have great potential for effective testing of driving knowledges. However, they also represent the most expensive approach. In addition to the production cost, there is the film cost itself. A 30 minute test requires 30 minutes of film, even though much of the time it is simply waiting for the applicant to select an answer. The use of multimedia approach would save on film but at the cost of special equipment. Whether the potential advantages of motion picture film outweigh the additional expense is something that future study will have to decide.

Foreign Speaking Applicants

The skills and knowledges that are required simply to maneuver a car do not differ much from one country to another. However, what it takes to drive a car safely certainly does. Rules of the road, traffic signs and signals, highways, and the characteristics of traffic vary substantially. What is even more variable is the extent to which drivers possess these knowledges. In the United States, years of license testing, driver education, safety campaigns, and strict enforcement have produced what is probably the most disciplined traffic system in the world. Many drivers arriving from other countries are simply unprepared to enter this system.

Where a particular foreign speaking population is heavily represented in a particular State, printed license tests are usually prepared in that language. However, in most States there are significant numbers of drivers representing language groups that are not sufficiently populous to warrant preparation of written tests. In some cases the facilities required for printing in a foreign language are unavailable. The practice generally employed in oral testing of foreign speaking drivers is to have them supply an interpreter who can read the questions to them. At least that is what the interpreter is supposed to be doing. The examiner has no way of knowing whether the interpreter is supplying the questions or the answers.

Almost any system capable of testing reading disabled applicants will also accommodate those who speak only a foreign language. Since pictorial presentations contain no text, they can be shared by all language groups. The oral presentation could be prepared in a number of languages without great cost. Each licensing station could be supplied tape cassettes covering a dozen languages for under $100.00. Oral presentations should be prepared to cover even those languages for which printed tests have been prepared in order to meet the needs of those applicants who are not literate in their own language.

CHAPTER V

EVALUATION

The need to give drivers a license test and to supply them a manual to prepare for it has never been seriously challenged. Therefore, few license agencies have felt compelled to evaluate what their license test program is accomplishing. However, as programs expand beyond the bare essentials--as more and better manuals are prepared, as special test equipment is purchased, as alternative ways of getting the word out are explored--questions as to the value of the license program will inevitably arise. In order to answer these questions, proponents of the program will have to undertake some form of evaluation.

How should a driver information program be evaluated?

If information is to do drivers any good, they must learn it, remember it, and use it. Each of these processes represents a point at which an information program can be evaluated. The following sections will describe techniques for evaluating the effectiveness of a safe driving information program in leading to the acquisition, retention, and application of information.

EVALUATION OF INFORMATION ACQUISITION

The first step in evaluating a driver information program is to find out whether the drivers are actually learning the information. Certainly information can't be retained or applied if it isn't acquired in the first place. Evaluation of information acquisition should involve at least the following three processes:

Developmental Evaluation--A review of the information system during its development.

Pilot Test Evaluation--A tryout of the information system following its development.

Operational Evaluation--A continuing evaluation of the information system while it is in use.

Developmental Evaluation

While manuals and other materials are being developed, they should be reviewed by a group of drivers who are similar to the drivers for whom the materials are intended. This "user" review is over and above any review or analysis performed by the people developing the materials.

The purpose of the developmental evaluation is not to find out how good the materials are, but rather to identify specific things that are wrong with them. Drivers participating in the review should be asked to

identify the following:

1. Information that is difficult to read or understand, is particularly uninteresting, or is considered offensive by those reviewing it.

2. Test items that are hard to understand or that appear to have either no correct answer or more than one correct answer.

3. Illustrations that are difficult to make out or interpret, or which do not appear to contribute to understanding of content.

4. Specific words that are not understood and have not been explained.

The number of drivers participating in the developmental evaluation may be quite limited--ten to twenty--so long as they are generally representative of the population for whom the materials were designed. Materials designed for New Drivers should be reviewed by new drivers; experienced drivers might miss certain gaps or deficiencies because they already have the information. Materials intended for Traffic Violators should be reviewed by convicted traffic offenders; they are better able to judge the emotional reaction of the ultimate recipient than are other drivers.

It is often more convenient to seek prospective reviewers in groups rather than as individuals. Use of groups has the advantage of (1) allowing the group leadership to help in securing participation, (2) simplifying the dissemination and collection of materials, and (3) allowing instructions to be given to everyone at one time. Potential sources of reviewers for various target groups include the following:

New Drivers--High school driver education classes (youth), commercial driving schools (adults).

Renewals--Community organizations, particularly service organizations.

Older Drivers--Community senior citizen groups, retirement associations.

Traffic Violators--Driver improvement programs.

Drinking Drivers--Alcohol safety education courses.

Commercial Vehicle Operators--Trucking and transit companies.

Motorcycle Operators--Motorcycle training programs, Motorcycle clubs.

Emergency Vehicle Operators--Fire, police, rescue agencies.

Recreational Vehicle Operators--Trailer camps, associations.

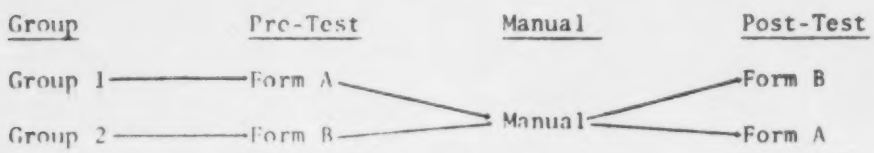
There does not appear to be any known established group of people involved in accidents. However, materials could be sent individually to drivers who have recently submitted accident reports.

Pilot Test Evaluation

Once a manual and test have been completed, they should be pilot tested on a representative sample of drivers to determine their effectiveness in leading to information acquisition.

Pilot Test Design

A scheme for conducting a pilot test is shown in the figure below.



The procedure would be as follows:

1. A representative sampling of drivers would be obtained from the same general sources as used in the developmental evaluation. If possible, somewhere in the neighborhood of 100 drivers should be sought.

2. The sample should be randomly divided into two groups, arbitrarily called Group 1 and Group 2. If the people vary considerably with respect to some variable, such as age, they should just be organized into matched pairs of individuals. Then one individual in each pair should be randomly assigned to each group.

3. The total pool of test items should be divided into two forms, arbitrarily called Form A and Form B. The procedures for preparing alternative forms that was described in the last chapter may be used to assure that the two forms are representative and equivalent. If forms A and B are known to be

equal in difficulty, one may be used as a pre-test and the other as a post-test. However, if there is any doubt, splitting the two forms will prevent differences in difficulty from affecting the measurement of gain.

4. Participants should be administered the two forms as a pre-test before receiving the manual being studied. Group 1 should be administered Form A, Group 2, Form B. After the tests have been collected, the manual should be disseminated and participants asked to study them for a post-test. If the manual is sufficiently slim and the groups cooperative enough, the pre-test and post-test might be administered at the same session. More often, however, participants will have to take the manual with them and return for a post-test.

5. After the manual has been read, participants will be administered the two forms as a post-test. Group 1 should receive Form B and Group 2 receive Form A. The switching of the forms for the post-test prevents previous exposure to test items from influencing the post-test results. It is a good idea to put names on test forms in advance of the post-test to be absolutely sure each participant gets the correct form and no one receives the same form on both administrations.

If only one test form is available, it becomes necessary to use two groups. One group receives only the test, while the other receives the manual and then the test. The group that takes only the test establishes the pre-test level for the second group. For this approach to succeed, both of these groups need to be equivalent at the outset.

Analysis of Information Gain

The effectiveness of a manual in getting the word across can be calculated by comparing the pre-test and post-test scores. The difference between the two is the measure of information gain. This gain can be expressed as a percent of pre-test score. Where two forms are used, the gain would be calculated as presented:

Pre-Test	Post-Test
Mean of Form A = 58	Mean of Form A = 76
Mean of Form B = 62	Mean of Form B = 74
The Pre-Test Mean = 60	The Post-Test Mean = 75

Percent gain equals $\frac{\text{post-test mean - pre-test mean}}{\text{pre-test mean}} = \frac{75-60}{60} = 25\%$

Notice that, because the two forms and two groups are represented equally in pre-test and post-test, the measure of gain is unaffected by whatever slight differences there might be in the difficulty levels of the forms or ability levels of the two groups. The significance of the gain can be assessed through standard statistical tests. If two different groups are used, a simple t-test would be performed to determine the significance of the difference between the two groups. If a single group is used, as in the design recommended, the individual gain scores can be used to obtain a more powerful test of significance. This is an additional advantage of obtaining pre-test and post-test measures for the same group. A worked example follows.

Examinee	Pre-Test Score	Post-Test Score	Gain Score
1	12	14	+2
2	7	10	+3
3	8	8	0
4	14	15	+1
5	13	15	+2
6	10	11	+1
7	9	10	+1
8	8	12	4
9	9	9	0
10	6	8	2
$\bar{X}$	9.6	11.2	1.6
σ	2.50	2.56	1.2
σd	1.18		.4
t	1.35		4.0
P	7.05		<.01

Should it happen that the two forms turn out to be unequal in difficulty, the raw scores may be converted to standard scores using the pooled pre-test and post-test results for each form. This will remove the effect of differences in form from the measurement of error and increase the chances of finding statistical significance.

Identifying Deficiencies

While a measurement of overall gain is of interest, the primary objective of the Pilot Test is to identify deficiencies in the manual and test. The following procedure will help in meeting this objective.

1. Tabulate Response Patterns

The first step in analyzing manuals and tests is to tabulate the individual item response patterns. For each item, count the number of participants selecting each of the response alternatives. Separate tabulations for the pre-test and post-test of each form. Unless the number completing the post-test is identical to the number taking the pre-test (sometimes there are losses), it is a good idea to change the numbers to percents. If automated test scoring and data processing equipment are available, their use will greatly expedite the tabulation. Otherwise, with only 100 or so participants, hand tabulation is time-consuming but manageable.

2. Analyze Tests

Examination of response patterns on pre-test and post-test results may help in identifying poorly constructed test items. Analysis should focus upon the following:

High Pre-Test Score--Look closely at any item having a high pre-test score, e.g., 90% or more. The wording of the item may be a giveaway.

Low Post-Test Score-- Examine any item showing a very low post-test score, e.g., 50% or lower. The item may be misleading, ambiguous or otherwise badly worded.

Rejected Alternatives--Examine any alternative that attracts no response on either the pre-test or post-test administrations. See if the alternative may be so unplausible as to eliminate itself.

There is nothing in the analysis of response patterns that can be counted upon to reveal deficiences in items. All an analysis can do is to point attention in the direction of items that may be poorly constructed. The analyst will have to decide whether the item is truly assessing

knowledge of content. A high pre-test score may mean only that everyone has the information in advance. A low post-test score may mean only that a manual is failing to communicate effectively. Both are potential problems. But the problems aren't necessarily in the test.

If any items are eliminated at this point, it may be desirable to recalculate gain scores. This can be done by averaging the percentages from the remaining items; it is not necessary to re-score the tests.

3. Analyze the Manual

The response patterns of those items that are considered acceptable should be examined as a means of identifying deficiencies in the manual being evaluated. The items of concern are those that exhibit the following pattern:

No Gain--Except in the case of items with very high pre-test scores, the failure of any gain to appear between pre-test and post-test indicates that the information is not being effectively communicated by the manual. A small gain is not particularly ominous; with a relatively small sample, individual item statistics tend to be unstable. However, no gain whatever means that few readers, if any, managed to acquire the information. It points to the need for some revision in content or format of the manual to give greater emphasis (assuming the information is there at all). Sometimes a comparison of pre-test and post-test errors will show an apparent information loss. When this occurs it generally indicates some mistake that is misleading the reader.

Low Post-Test Scores--Items that are answered correctly by less than 70% of those taking the test point to information that is not getting across to everyone, even if there has been a gain among the group at large. Again, some revision of the manual to give greater emphasis to the information involved is indicated.

High Pre-Test Scores--Very high scores on a pre-test--e.g. 90% or more--point to things that people know before they read the manual. It doesn't mean the information should be deleted from the manual, particularly if it is highly critical. For example, almost everyone knows what a red traffic signal means. Yet, it is important enough information to appear in the manual for those few people who don't know its meaning. However, information of relatively low criticality might be dropped or at least abbreviated.

Test Reliability

In order to be used widely in measuring information acquisition, a test must provide a reliable estimate of what an applicant knows. This means that the questions on the test must be representative of the information that is in the manual, and that there must be a sufficient number of questions to provide a reliable sample. The things that can be done to a test to make it reliable were discussed in the last chapter. The Pilot Test represents a good point at which to determine the success of these efforts.

Measures of test reliability fall into three categories: Test-Retest, Internal Consistency, and Alternate Forms.

Test-Retest

Test-Retest reliability assumes that, if a test is reliable, administration of the test at different times should give the same results. It should, unless something has changed in the interim. One does not conclude that a thermometer is unreliable just because it doesn't always give the same reading. Nor should one conclude that a test is unreliable just because it doesn't yield the same score. The examinee may have learned something that improves the score (such as the answers to the missed questions), or forgotten something and thereby obtained a lower score. There is no more reason for test scores to stay the same than for temperatures to do so. In the case of knowledge tests, test-retest measures are a better index of learning and forgetting than they are of estimating reliability.

Internal Consistency

Internal consistency measures are based upon the premise that items purporting to measure the same thing should yield the same result. People who have whatever the test measures will answer all items correctly, while those who do not will answer them all incorrectly. This premise is acceptable where all items are truly intended to measure the same thing, such as "mathematical skill" or "sociability." However, items on a test of driving knowledge don't all measure the same thing. Some are concerned with the car, others with rules of the road, and still others with the effect of weather conditions. Some items deal with information that can only be found in a book, others with lessons of experience.

Given the varied nature of driving knowledge, it would not be surprising to see people doing well on some items and poorly on others. All we can ask is that the total test provides a reliable estimate of the individual's total knowledge. An internal consistency measure that correlates one-half of a test with another would be appropriate if each half was selected so as to constitute a representative sample of manual content.

Alternate Forms

If each alternative test form provides a representative sample of the driver's knowledge, then an individual's score on each alternate form should give the same results. The more closely the scores on the various forms correspond to one another, the more reliable is each score as an estimate of the driver's knowledge.

The most common expression of alternate form reliability is the correlation between forms. The correlation represents the ratio of true variance to total test variance. A correlation of .90 means that approximately 90% of the variation among people on particular tests represents true difference in knowledge.

Where there are only two forms of the test, a simple product-moment correlation between the two forms will provide a coefficient of reliability. Where there are several forms, the calculation of many pairs of correlations becomes laborious. A simpler approach is to use the intra-class correlation obtained through an analysis of variance. The correlation is given by the following formula:

$$r = \frac{\sigma_A^2 - \sigma_E^2}{\sigma_A^2 + (k-1)\,\sigma_E^2}$$

where: σ_A^2 = variance between applicants

σ_E^2 = error variance, that is, variance within applicants (across different forms)

k = number of forms

An example of the application of the formula appears on the following page. The numerator, being the total variance in applicant score minus the error variance, corresponds to the true variance in scores. The denominator represents the total variance. The ratio, therefore, corresponds to the average correlation among the various test forms.

One limitation to the use of correlation as an expression of reliability is its sensitivity to overall variability in test scores. If everyone scored 100 on all tests, the correlations among test forms would all be zero. Of course, such a situation would never prevail. However, if a test samples only information that is contained in the manual, and if the test is well-constructed and a high passing score is imposed, it would not be surprising if the great majority of scores were in the 80-100 range. The reliability coefficient would probably be quite low, even if the test were providing an accurate assessment of applicant knowledge. What this means is that any correlations among test forms must be interpreted in light of the overall variability in scores.

EXAMPLE OF INTRA-CLASS CORRELATION FOR MEASURING

THE RELIABILITY OF FIVE TEST FORMS

Applicant	A	B	C	D	E
1	90	86	94	92	88
2	64	50	64	58	56
3	84	88	82	82	80
4	76	80	72	78	86
5	60	68	64	64	66
6	84	90	88	86	87
7	82	76	74	78	76
8	98	96	100	96	92
9	60	58	60	66	64
10	86	82	88	84	84

	Σx^2	df	σ^2
Applicant =	7377.62	9	819.74
Test Form =	9.52	4	2.38
Error =	504.88	36	14.02
Total =	7892.02	49	

$$r = \frac{819.74 - 14.02}{819.74 + (4)\ 14.02} = .92$$

In license testing, a more useful statistic is the "Standard Error of Measurement," which is an estimate of the dispersion of obtained test scores around an individual's true score. Where only two forms are involved, the standard error of measurement is given by the formula $SE_m = \sigma \sqrt{r}$ where σ = the standard deviation of all test scores (both forms), and r = the correlation between forms. Where intra-class correlation is used, the standard error of measurement is simply the square root of error variance. In the example of intra-class correlation, the standard of error measurement equals $\sqrt{14.02}$ or 3.47. The chances are 95 in 100 that an examinee's obtained score will fall within a range of 2 SE_m either side of the true score. In the example, an examinee who could answer 80% of all possible questions correctly would be almost certain to score within 2 SE_m or about 7 points of his true score on any one test form. This would suggest that the various test forms are providing a fairly reliable estimate of the applicant's knowledge.

Assessment of Reliability

Assessment of reliability should take place under conditions that are as much like those of operational license testing as possible. The best approach would be to induce a group of 25 or more applicants to take all forms of the test. If this isn't possible, then the cooperation of some group of drivers, similar in driving experience and general background to those for whom the test is intended, should be solicited.

Examinees could be given a single test consisting of an entire item pool. Alternate forms of differing lengths could be constructed and reliability coefficients calculated under each condition of test length. This would allow reliability to become a consideration in establishing the length of tests.

A Final Note on Reliability

It is certainly reasonable to ask that a test provide a reliable estimate of an applicant's knowledge if it is to be used in deciding whether or not the applicant will be issued a license. However, it is important to bear in mind that the purpose of the test is not so much to see if applicants already have information as it is to see that they get it by reading the appropriate manual. Most of what a test can accomplish has already taken place before the applicant shows up at a license station. True, if a test has a large error of measurement, many people who have the requisite knowledge will fail the test and have to take it a second time. Conversely, many people who do not have the requisite knowledge will pass the test and not have to reread the manual. These risks must be weighed against the costs of administering lengthy tests. If it should become necessary to use a test that has a large error of measurement, the passing score should be set high enough to make it very unlikely that a truly uninformed applicant will succeed in passing.

Operational Evaluation

Since the conditions under which a Pilot Test is conducted do not match those in which an information system will ultimately be used, the results merely provide a rough estimate of effectiveness. Generally speaking, Pilot Test participants will study a manual somewhat less assiduously than those whose license is at stake. Therefore, their information gain would be somewhat less than that which would occur in an actual licensing application. Moreover, the numbers of individuals who can be induced to participate in a Pilot Test is quite small relative to those who are involved in an operational application. These factors permit a much greater degree of precision in estimating the level of information acquisition than is possible during the Pilot Test.

The results obtained during operational use of the test may be used to refine the estimates of information gain and to detect additional deficiencies in the manual and test, deficiencies that may be corrected in later revisions. The types of comparison would be essentially the same as those described in the last section.

EVALUATION OF RETENTION

Few States have ever made an appreciable effort to find out how much drivers remember of what they learn through the driver manual. It seems to be tacitly assumed that drivers generally retain what they have once mastered. This is likely to be true of information drivers have the opportunity to use. However, much of the information that appears in the manual is seldom used. Information concerning such emergencies as skid or brake failure may not be put to use for years. Information intended primarily to motivate drivers, such as reasons for wearing seat belts, may be forgotten if drivers are not provided occasional reminders.

Identifying information that people tend to forget can help to improve a safe driving information system in two major ways:

- By identifying areas in which the initial presentation of information can be improved so as to make it more resistant to forgetting.
- By identifying appropriate topics for periodic reeducation and reassessment through a renewal program.

Retention Periods

For most types of information, the curve of retention shows the steepest rate of forgetting occurring shortly after the information is learned, with a gradual leveling off over a period of months. A retention

test conducted six months after initial acquisition should provide a good estimate of overall information loss and reveal those items of information most susceptible to forgetting. However, additional retention tests at one-year and two-year periods may reveal additional losses.

Sample Selection

A measure of retention will depend as much on initial acquisition levels as they will upon results of the retention test. Therefore, the retention sample must be selected from drivers taking the original acquisition test under the incentive of a regular licensing action. The use of groups such as those described in the case of the Pilot Test would be inappropriate since acquisition levels would not be representative of those prevailing in licensing.

A random sample of drivers who took the acquisition test at about the same time--the date which begins the designated retention period--should be randomly selected from driver records. Enough drivers should be sampled to provide at least 150 for each of the test forms used in acquisition testing. If original test scores are posted on driver records, the mean scores may be compared with those of the acquisition test results to see if the group is representative of the drivers in the acquisition test sample.

Retention Testing

The next stop is to send retention test forms to drivers in the selected sample. If the form of the test originally taken by the driver can be identified, an alternate form should be assigned so as to prevent the effect of acquisition testing from influencing the estimate for the retention of the manual as a whole. However, the inability to impose this limitation should not materially affect the outcome. If several alternate forms are used, only a small portion of the sample will get the same form twice.

Since States rarely authorize driver licensing agencies to require retention testing solely for research purposes, the cooperation of individual drivers must be sought. A covering letter should

- Introduce the project as a highway safety measure and seek voluntary participation.
- Request that the test be taken without any study.
- Assure the driver that results will not affect the status of the driver license.
- Provide a deadline for returning the test.
- Furnish a local telephone number to which inquiries may be addressed.

- Provide a stamped, return envelope.

The deadline should be approximately one month following the mail-out to allow for postal delays, absences due to vacations or business, illness, or other commitments. Approximately two weeks after the deadline, a letter should be sent to non-respondants, urging them to complete the test and mail it back. Those who respond should be sent a short thank you note, a report of their score, and if possible, an identification of the items incorrectly answered.

Analysis of Results

The cooperation of at least two-thirds of the original retention sample is nessary for a meaningful study of retention. The original solicitation letter, together with a follow-up should provide the necessary return. While a one-third non-response is unhealthy, it is not fatal to retention measure. There is no reason to believe that those who respond would be significantly more or less forgetful than those who do not. It is quite likely that, being more cooperative generally, they will have somewhat higher acquisition scores. For this reason, their degree of forgetting should be figured against their own initial acquisition level and not that of drivers in general.

The analysis of retention scores would parallel that described in analysis of information acquisition. The difference between mean retention score and mean acquisition score will indicate the amount of forgetting. It may be divided by the mean acquisition score to provide a "percent" loss.

It is quite likely that individual test items will differ widely in their susceptability to forgetting. An item analysis should be performed to identify that information which is most vulnerable. The results would be used to form the basis of a communication to be sent periodically to licensed drivers. The type of Renewal Manual described in an earlier section is an example of such a communication.

EVALUATION OF INFORMATION APPLICATION

The proof of a safe driving information program lies in its effect upon highway accidents. The number and severity of crashes experienced by drivers is not only the most valid available index of the effectiveness of the program, but also provides the most convincing evidence that can be offered in its behalf. Drivers can report they are driving more safely; they might actually be observed to be driving more safely. But, unless it all shows up in a reduction of accidents, the true effectiveness of manuals and tests has not been proven. For this reason, the following discussion of techniques for evaluating information application will focus almost exclusively on the use of accident data.

General Approach to Evaluation

The validity of license tests as a means of preventing accidents has typically been measured by determining the correlation between test score and number of accidents. The use of correlation in estimating validity is not confined to license tests; it is almost universal.

What does a correlation between tests and accidents prove?

Only that the two are related. As almost everyone knows, correlation does not establish cause. It cannot show whether the information the test covers is having any effect upon accidents. What is causing the correlation may be something else entirely. Some of the factors that are likely to influence the relationship between test scores and accidents are--

> Age--Younger drivers tend to do better on tests but have more accidents.
>
> Sex--Females tend to do better on tests and have fewer accidents.
>
> Socioeconomic Factors--Drivers who come from the better part of town tend to do better on tests and have fewer accidents.

True, the effect of these other factors can be controlled statistically--when we know what they are. The problem is that there may be any number of unknown factors that could cause a correlation to appear between test scores and accidents.

In theory, a knowledge test that correlates with accidents could be used to reduce accident rates, whether the correlation was due to the knowledge or not. By keeping those with low test scores and a high accident potential off the road, the accident rate should decline. It probably would, if the low scorers could be kept off the road. But the great majority will read the manual more thoroughly, retake the test, and eventually pass it. If the correlation between test scores and accidents were due to factors other than knowledge, the accident potential of all these drivers would be just the same as it was. Use of the test would not have any effect on accident rate.

The sum of all this is simply that a correlation between test score and accidents provides no estimate whatever of the effect that using the test and its associated manual will have upon accidents.

Experimental Evaluation

The only way in which the effectiveness of a driver information system can be validly assessed is through an experiment in which some

drivers receive the information and some drivers do not. If the decision as to who gets the information and who does not is randomly determined, then the only difference between the two groups is the information itself. This allows any difference in accident rate to be attributed solely to the information system.

The superiority of an experimental over a correlational approach is not confined to driver licensing. It is basic to scientific inquiry. A correlational approach surveys things as they are. While the relationship between two things can be measured, there is no way that the survey can determine for certain what are causes and what are effects.

There are circumstances in which an investigator is prevented from making changes, or at least from making them on a random basis, by legal, social, or physical constraints. In such cases, a survey approach is the only alternative to doing nothing at all. However, driver licensing is not one of those circumstances.

Experimental Controls

If the effects of an experimental program are to be measured, the results obtained from some group must be compared with those obtained by a group that is the same except for the program. The only way to make sure the groups are the same, except for the program, is to assign people at random to the two groups before introducing the program. Random assignment is essential.

Some experiments have been performed by taking groups that already exist and trying to match people as closely as possible. This will make the matched groups the same as far as the matching factors are concerned. However, they may differ drastically in other factors. Another approach is to use a single group and compare differences before and after an experimental change is made. The trouble is while the people remain the same, the conditions may change. What happens may be due to changes in conditions.

If people are randomly assigned to two groups, the only differences among the groups are those that occur by chance, and those differences can be controlled statistically. If the groups are relatively small, it is a good idea to match them in terms of factors that may affect the result, such as age and sex in the case of licensing. However, after the matching, the people should be assigned randomly to groups. This assures that whatever differences remain between the two groups are random differences. The large samples required in evaluating the licensing program generally make it unnecessary to resort to matching.

Sample Size

Assume that a new manual for motorcycle riders has been given to a randomly selected group of 1,000 riders while another random sample of equal size receives the previous manual. Let's say that after a year we found that 20% of the riders receiving the new manual had had an

accident, while 19% of those who received the old manual had an accident. Would we be correct in assuming that the new manual was worse than the old one? Or, could we simply say that it wasn't any better?

The fact is we cannot say either. Motorcycle accidents result from many other factors than knowledge. Chance fluctuations and the other factors could easily produce a difference of 1% in a group of 2,000 drivers. The difference is not significant, and therefore, we cannot say that the new manual isn't any better. Had the new manual been given to every motorcycle rider in the United States, we might well have found that 1% difference in favor of the new manual. This would have meant a prevention of several thousand accidents with a dollar savings running well into the millions. Yet, someone running a small sample study could well conclude that the new manual had no benefit and could have abandoned it without trying it on a larger sample.

This example represents the problem of sample size in studies involving accidents. Many studies have concluded that a particular accident countermeasure had no significant effect when the samples were so small that a real effect could easily have been obscured by chance fluctuations in other factors. Where the effect that they do observe is in the right direction, they may have concluded that the countermeasure "has promise" and expanded the study. But if it happens to come out in the wrong direction, as in the above example, they may abandon it.

A sample must be sufficiently large to assure that any difference great enough to be worthwhile will manifest itself in the sample. Therefore, in determining sample size, we need to determine:

- What is the minimum acceptable difference, the smallest difference that is worthwhile.
- How many drivers are needed to assure that, if a difference of the required size exists in the driving population at large, it will show up in the sample.

Minimum Acceptable Difference

The smaller the difference we are willing to accept, the larger the sample must become to provide a test of its significance. It is important, therefore, that the minimum acceptable difference be made no smaller than can be justified.

One way of deciding what a difference needs to be is to apply a cost-effectiveness criterion. Using this approach, a difference in accident rate must be sufficiently large that a reduction in accident costs resulting from the countermeasure--e.g., manual and test--equal or exceed the program costs required to produce them.

Program Costs

The program costs are the easiest to estimate. They include the following:

Agency Costs

Preparing and printing manuals and tests

Disseminating manuals

Administering and scoring tests

Examiner and clerical time

Equipment cost

Facilities cost

Applicant Costs

Transportation

Time required for testing

The inclusion of applicant testing time is based upon the fact that most tests are administered during normal working hours.

Accident Costs

Accident costs include the following:

Property Damage--Cost to repair the vehicle or other structure involved.

Personal Injury--Medical and hospital bills, cost of drugs, transportation, etc.

Lost Work Time--Cost resulting from work time lost whether compensated or not (somebody pays for lost work).

Lost Earnings--Loss of earnings due to disability or death of primary breadwinner.

Loss of Vehicle--Costs of transportation while vehicle is unavailable.

Since the effectiveness of the program will be evaluated against reported accidents, estimates could be based upon accidents involving personal injury or property damage in excess of minimum for reporting. The cost of an average automobile accident has been estimated at as low as $2,000 per accident and as high as $5,000 per accident. This spread does not inspire much confidence in either estimate. For purposes of

estimating sample size, the $2,000 figure is the more "conservative" in that it requires a program to show a greater payoff.

Based on program costs and accident costs, the difference in accident rate that is required to enable a manual and test to pay for itself is:

$$D = \frac{\text{cost of program per driver}}{\text{cost per accident}}$$

If the cost of a particular manual and test equals $5.00 per driver, and the accident cost is $2,000 per accident, the difference in accident rates required for the program to pay for itself equals 5/2000 or .0025, a difference of one accident in 400 drivers.

Number of Drivers Required

The number of drivers required to establish the statistical significance of a minimal cost difference can be roughly estimated by the following formula:

$$N = \frac{Z^2 \ (2PQ)}{D^2}$$

where: N = number of drivers required in each group being compared
Z = the standard score corresponding to the selected confidence level - 1.96 for a 95% confidence level
P = The proportion of drivers having an accident during the period of the follow-up
Q = 1-P
D = minimally cost-effective difference.

Using the minimally cost-effective difference arrived at in the preceding paragraph, and assuming an overall 1 year accident rate of .06, the sample size requirements would be as follows:

$$N = \frac{1.96^2 \ (2) \ (.06) \ (.94)}{(.0025)^2}$$

Since N equals the number of drivers required in each group, the total sample requirement would be 139,784. A total sample this large would be necessary before an investigator would have reasonable assurance that a manual capable of producing a .0025 reduction in accident rate would reveal itself in an experimental comparison. It is small wonder that studies performed in the past, few of which provided a tenth as many drivers, failed to find significant differences.

One should not conclude from this example that it takes more than 100,000 drivers to assess the effectiveness of a manual and test in

reducing accidents. The true difference in accident rate might be much greater than that which is minimally cost-effective. If the manual and test were actually capable of producing a .01 change in accident rate, then only a little more than 3,000 drivers would be required in each group. One might well initiate a study with a sample smaller than that needed to establish the significance of minimally cost-effective difference. However, in doing so one should recognize that failure to obtain a statistically significant effect will not allow any conclusions to be reached about the potential value of the manual and test to a licensing program. If possible, provisions should be made to continue the evaluation until the full sample has been obtained.

Evaluating Operational Programs

The cost of performing an evaluation is not necessarily highly correlated with sample size. It is if the program being evaluated were purely experimental and evaluation were required to bear the expense of preparing and disseminating manuals as well as administering and scoring tests; then each driver in the sample will add to the cost of the evaluation. However, if the particular program were being instituted on an operational basis, an evaluation could be performed by withholding the new program from some randomly selected group of drivers and following up the accident experience of both groups over a period of time. The costs of the evaluation itself would only be those of controlling who got what manual and test and those involved in conducting the accident follow-up. Where the identification of drivers and the search of driver records can be automated, the primary costs would be those of programming. Such costs are not particularly sensitive to the size of the sample itself.

Evaluation Procedures

The mechanics of the evaluation process depend too much upon the standard operating procedures of individual licensing agencies to be set forth in detail. What follows is a set of recommendations based upon experiences gained from the Driver Manuals Project.

Random Assignment

Probably the most critical aspect of evaluation is the process by which drivers are randomly assigned to experimental and control groups. It must assure that the two groups are equal, subject only to forces of chance. A minimally cost-effective difference in accident rate of only 1 accident in 400 could easily be obscured by some difference introduced by the way in which the groups were selected.

"Random" does not mean "haphazard." It means subject to a process known to conform to the laws of chance. It is best if the randomization involves some characteristics of the drivers themselves. Two suitable

characteristics are the following:

- Driver License Number--If all of the drivers in a sample are already licensed (e.g., Renewals, Violators), some random digit in the license number may be used for assignment. For example, odd number digits could be assigned as Experimentals, even number digits as Controls. However, the digit must be random and not a reference to place of residence, year of birth, or some other non-random characteristic.

- Birth Date--Where drivers have not been assigned a number, day of birth represents an easily identified characteristic. Each day of the year could be randomly assigned to one of the groups being compared and individual drivers then assigned to a group according to their birth day.

Where neither of these characteristics is known, drivers may be assigned by coin-flipping, use of random number table, or other random process. It is important in such cases that the group assignment be immediately entered onto some permanent record so as to be available during the information dissemination, testing, and evaluation process.

Some information programs will reach drivers on a group rather than an individual basis. An example would be a manual designed for use in high schools or driver improvement classes. To prevent inter-mixing of programs, it is best to assign entire classes to the experimental or control treatment.

Dissemination of Information

No dissemination of information in the evaluation would utilize the same system that would be employed in normal operation of programs. Dissemination systems can be divided into two basic categories, mail and personal contact.

Mail

Dissemination of information through the mail, since it can be tightly controlled, is the most reliable system, despite occasional inconsistencies introduced by the postal service. It can only be employed where drivers can be identified in advance (e.g., Renewals and Problem Drivers). The major drawback is cost. The expense of sending materials through first class mail can become prohibitive. Third class mail becomes a problem if the addressee has moved, in which case the material is neither forwarded nor returned. This means the driver does not receive the information and the licensing agency is unaware of it. Therefore, if third class mail is used to disseminate materials, drivers should be sent a first class letter apprising them of the program and directing them to a source of materials if theirs does not arrive.

Personal Contact

Where drivers cannot be identified in advance (New Drivers, non-residents, Special Vehicle Operators) the control of dissemination will have to be exercised where drivers normally pick up materials. Even where drivers can be identified in advance, mailing costs may dictate that drivers be directed to a licensing station to obtain the materials.

The personnel who will be responsible for the distribution of materials--licensing clerks, teachers, driver improvement analysts--must become thoroughly familiar with the distribution procedures including:

- The random assignment process
- Methods of recording and posting group assignments
- Answering questions phrased by drivers concerning the nature of the information, testing procedures, and sources of assistance.

This has led to use of "self-service" approaches in which distribution is controlled by having experimental materials available at certain locations or certain times while standard materials are available at other locations and times. Such an approach is non-random and is almost certain to result in confusion. Unless the distribution of materials can be controlled in a way that assures randomness and allows the positive identification of people by group, a valid evaluation cannot be performed.

Information Assessment Procedures

The crucial element in information assessment is making sure that drivers are tested on the information they were provided. If drivers are administered the wrong test, their knowledge will be underestimated. This is disconcerting to the applicant and provides faulty information to the evaluation. Administration of the wrong test may also result in data being ascribed to the wrong group. Methods of assuring that drivers receive the correct test include the following:

Coded Application--At the time manuals are distributed, drivers may be furnished a coded application card which identifies their group assignment. In the Driver Manuals Project, applications, manuals, and tests were all color coded by group. If drivers are impressed with the importance of the application card in assuring that they receive the correct test, a majority can be counted upon to retain it. However, since not all will do so, an alternative method of identification must be available.

Rosters--Where drivers will be tested in groups (e.g., driver improvement programs) examiners may be furnished rosters to help them identify which test each group gets, and who is assigned to the group (in case someone shows up in the wrong group).

Records Access--Regardless of what system of identification is used, the examiners should have access to a master record of group assignments. Where stations have terminal access to a driver records file, the posting of assignment on the driver record will provide positive identification. Otherwise, computer printed lists, updated frequently, will suffice.

Driver Characteristics--Where birth date of license numbers are used for assignment purposes, it can also be used by clerks to identify which tests the drivers receive. However, the likelihood of a clerical error is sufficiently high to encourage the additional use of one of the above approaches.

Recording Information

The following information should, if at all possible, be posted on the driver record maintained by the licensing agency:

- Participation in Evaluation--A code that allows any participant in an evaluation program to be readily identified. In conducting an accident follow-up, it will generally be most efficient to conduct a single records search of drivers in all programs.

- Program Identification--A code indicating in which of several possible information programs the driver is a participant (e.g., New Driver, Renewal, etc.)

- Experimental Assignment--A code indicating whether the driver is assigned to an experimental or control group.

- Test Data--Codes indicating the test form administered and the score obtained on initial testing, as well as scores on any re-tests that were administered.

Verification

Periodically throughout an evaluation program, records should be accessed and analyzed to verify that evaluation procedures are being appropriately applied. Analyses should include the following:

- Random Assignment--The experimental and control samples should be analyzed to determine their makeup relative to age, sex, previous driving experience, and prior record of accidents and violations. Any significant differences between two groups should trigger an examination of assignment procedures.

- Test Results--Test results should be analyzed to determine the number of drivers passing and failing in the two groups being compared. A difference between groups may be a legitimate result of differences in the programs themselves. For example, those receiving the experimental manual may be better prepared for the test. On the other hand, it might be due to differences in testing procedures that are not a part of the program.

- Licensing--The licensing actions resulting from the program--initial license, renewal, endorsement, reinstatement--should be assessed. Again the differences may be attributable to characteristics of the program. For example, the introduction of a manual and testing requirement where none has previously existed, may tend to lower the licensing rate. However, since differences in licensing will lead to differences in accident exposure, they must be clearly attributable to the program and not some unanticipated change in administrative procedure.

Data Analysis

At periodic intervals, the driving records of experimental and control groups should be analyzed and compared. A discussion of analytic procedures would exceed the scope of the Handbook. What will follow is a set of suggestions for dealing with the problems that are specific to the evaluation of licensing programs.

Analysis Sample

With few exceptions, the final driver sample should consist of everyone originally assigned to it. Any change in the composition of the experimental or control groups jeopardizes their random character. Therefore, any changes made in the sample should be made only when there is clear justification for doing so.

Failure to comply with various provisions of the program should not result in elimination from the sample. For example, Accident Repeaters who fail to mail back examinations should not be excluded. There are some reasons for believing that those who do not respond will have a somewhat higher accident potential than their more cooperative counterparts. Dropping them from the experimental sample would lower its accident rate even though the program may not be accomplishing anything. Drivers should not be dropped from the sample unless the basis of their exclusion has an equal effect upon the groups being compared. Since this condition is hard to guarantee, the safest course of action is to leave the samples as they were originally constituted.

During the follow-up period, many drivers will be removed from the driving population by transferring to another State or failing to renew

their licenses. For the most part, departure from the driving population will effect both comparison groups equally. However, in some instances it may be a result of one of the programs. For example, a program initiated among older drivers may encourage some of them to give up driving. It is best, therefore, to keep transfers and non-renewals in the sample even though a search of their records will reveal no accidents.

Data To Be Analyzed

The number of accidents experienced by drivers participating in an information program offers the most valid and convincing proof of the effect the program is having. Where culpability has been established, accidents may be sorted into "at fault" and "not at fault" categories in order that the differential effect of the information program upon the two categories may be seen. However, most of the safe driving behavior sought by the programs that have been described would attempt to keep drivers out of accidents either as perpetrators or victims. Therefore, there is no real basis for expecting a differential effect. Culpability is probably more meaningful as a legal term than as a behavioral category.

Accidents could be classified according to such situational factors as weather, time of day, number of vehicles involved and so on. However, unless these data are easy to collect, it doesn't really pay to bother. First of all, the number of accidents in each separate comparison is likely to be too small to allow much significance to be attributed to the results. Secondly, as will be noted a bit later, the more comparisons that are made, the less significance can be attached to the results of any one comparison.

A traffic violation represents an observation of unsafe driving behavior. Therefore, people who have a lot of traffic violations should also have more than their share of accidents. Most studies have found a low correlation between violations and accidents over a short period of time. However, because accidents are so infrequent, it would be difficult to show a correlation between short term accident rate and anything. Since violations happen more often than accidents, they might conceivably provide a better index of driving behavior, and therefore a better indication of long term accident potential, than do the short term accident rate. If violations and accidents are recorded in the same place, e.g., individual driver records, then both data items can be collected at the same time. However, should it ever be necessary to choose between the two, accidents are to be preferred as the more valid indicator of driving safety.

Data Collection

The period of time over which accident and violation records are collected should be long enough to allow the effect of an information program to evidence itself. There is not much use in collecting accident data for at least a year after the bulk of the sample has benefited from the program. Only about 10% of drivers will have an accident in a one-year period. On the other hand, waiting until several years have elapsed unnecessarily delays evaluation of the program and could result in early benefits being overlooked. A two to three year period seems to be an optimum. If possible, data should be collected and analyzed at periodic intervals during this period. Where records are automated and the costs of data collection are primarily the fixed costs of programming, analyses might be profitably conducted at six month intervals.

Analytic Techniques

Methods for analyzing accident and violation data fall in the following two categories:

- Non-Parametric Analyses--analyses involving the numbers of drivers having accidents or violations.
- Parametric Analyses--analyses involving the number of accidents or number of violations experienced by drivers.

Non-Parametric Analyses

Non-parametric analyses are the most appropriate where drivers fall into the two categories "did" and "did not" with respect to having an accident or being convicted of a violation. Under such circumstances non-parametric statistics provide the most exact test of significance. The two most commonly employed non-parametric analyses are tests of proportions and chi-square. The methods for conducting each of these analyses can be found in any statistics text.

A test of the difference between proportions can be used to determine whether the proportion of drivers in the experimental group having an accident is significantly different from the proportion in the control group having an accident. It is simple to calculate but can only be used when there are just two groups involved. Chi-square can be used to compare several groups and test whether the numbers of drivers falling into various categories is significantly different from chance.

Parametric Analyses

While non-parametric statistics involve merely counting numbers of drivers, on an "all or nothing" basis, parametric statistics involve measurement of the drivers' attributes. For this reason, parametric statistics generally provide more sensitive analyses of an effect, and more powerful tests of significance, than do non-parametric statistics.

The problem is that parametric statistics are based upon certain assumptions as to the distributions of variables being tested. Unfortunately, the distributions of the accidents and violations over short periods of time do not conform to these distributions. While parametric tests can stand some violation of their assumptions, they are not equipped to handle distributions that consist of only two points: "did" or "did not" have an accident.

If data can be collected over a period of several years, so that actual distributions of accidents and violations begin to appear, then parametric analyses can and should be performed. The most rigorous test would be an Analysis of Variance. In this form of analysis, the variance in accidents is divided into that attributable to the programs being compared and that attributable to other factors, including such other accident-related factors as sex and age. This partitioning of variance makes for a more powerful statistical test and also allows any differential effects of the program on different age groups or sexes to be tested. Any standard statistical test will describe procedures for performing a factorial analysis of variance.

Covariance Analysis

Sometimes groups being compared turn out to be different from one another on some important characteristic. It might turn out, for example, that drivers in the experimental group were, for some unexplained reason, older than those in the control group.

The effect of differences between groups on accident-related or violation-related characteristics can be removed through the use of covariance analysis. In this example, the correlation between age and accidents would be used to adjust accident rates so that they come out just as they would have had the two groups been of equivalent age. Covariance analysis has been frequently used to adjust for differences in age, sex, mileage, and other accident-related variables.

There is a danger to the use of covariance analysis in studies of accidents and violations. With the large samples that are needed in such studies, any difference between two groups that is large enough to effect the outcome, could not arise by chance. It means either that

the groups were different before the study began, or the difference was produced by the study itself. In neither case will covariance analysis solve the problem.

Any difference between the two groups at the outset of the study points to a flaw in the randomization process. If randomization is faulty, then there are likely to be differences other than those equalized through covariance analysis. These differences could easily cover-up the small difference produced by an information program itself.

If the differences between groups is a product of the information program itself, then the use of covariance analysis will simply take away the effect the program has produced. Let us say, that the one effect of a renewal information and licensing program is to induce significant numbers of aged drivers to give up their licenses, thus producing a decline in accident rate. Any attempt to control for age differences through covariance analysis would amount to putting the aged drivers back on the road, depriving the new program of one of its possible accomplishments.

If an evaluation is well designed, there should be no need for adjustments through covariance analysis. If it is not well designed, no amount of after-the-fact statistical manipulation can make up for it.

Testing Hypothesis

Most statistical texts talk about tests of significance under the heading of "hypothesis testing." The tests of significance that are described all assume that the person carrying out the test started with some hypothesis as to the relation between certain things--such as the relation between use of a manual and number of accidents--and wants to know if the relationship that is found is real or due to chance. The test of significance tells the person what the probability is that a relationship as large as that found could have occurred by chance. If the probability is small enough--say less than 5 chances in 100--the "chance" hypothesis is rejected and the hypothesis that a real relationship exists is accepted.

What often happens is that a person conducting a study starts with many hypotheses about relationships. Either that, or the person looks at the data and pounces on those relationships that are found. When this happens, the probabilities of obtaining results by chance are no longer what the test of significance say they are. If 100 relationships are analyzed, it is amost certain that at least one of them would be

large enough to meet the "five chances in 100" probability; it wouldn't be surprising if five of them did so. This problem leads to the following recommendations:

1. Important relationships should be hypothesized in advance and tests of significance should be applied only to those relationships that are hypothesized.

2. The number of relationships tested should be held to a minimum by formulating hypotheses only where they are supported by theory or experience.

3. The hypothesis should be made as specific as possible. If, for example, an experimental group is expected to score higher on some variable, then the hypothesis should say "higher" and not simply "different." This cuts the chance probability in half and essentially doubles the significance of an obtained relationship.

4. The probabilities should be interpreted in terms of the number of relationships tested. If ten hypotheses are tested, the chances are rather good that one will appear "significant" by chance alone.

5. Significance tests should only be applied to those relationships concerning which hypotheses were offered in advance. Any relationships observed can become the basis for hypotheses to be tested in some future study. However, hypotheses cannot be tested on the same sample from which they were derived.

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